MACHINERY

MAY 3, 1961 ONE SHILLING AND THREEPENCE

HOFFMANN
ball and roller bearings...

decisively
for
exacting
demands...

HOFFMANN BEARINGS made from the highest quality steels and to the highest standards of precision, the product of more than sixty years' experience concentrated upon the design and manufacture of ball and roller bearings.

HOFFMANN

THE HOFFMANN MANUFACTURING CO. LTD. CHELMSFORD ESSEX

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TECHNOLOGY

ASQUITH

The PORTABLE UNIVERSAL RADIAL of modern design

The machine illustrated is a 5' 0" radius Portable Universal Radial.

UP-TO-DATE FEATURES

- Shaft drive from Motor (no belts)
- Ball bearing rolls to "in" and "out" traverse of arm
- Wide range of feeds and speeds
- Quick return after tapping
- Power and hand elevating and lowering to arm
- Exceptional ease of control

A robust machine of up-to-date design which ensures trouble free operation. It incorporates a large number of ball journal bearings; special attention has been paid to efficient clamping of the swivelling parts and shaft drive from the motor is a noteworthy modern feature. The arm can be elevated in a dead vertical position to facilitate tool changing, etc. Write today and ask for full details of the Asquith Portable Radial.
Built in 4 sizes with radius 4 ft., 5 ft., 6 ft. or 7 ft.

WILLIAM ASQUITH LTD.
HALIFAX · ENGLAND
Member of the Asquith Machine Tool Corporation

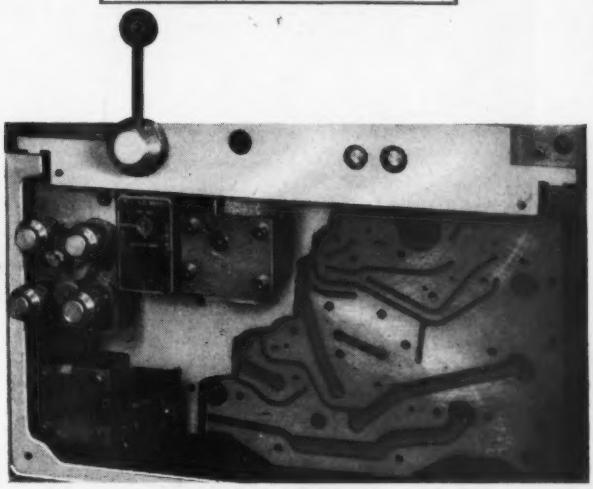
Sales and Service for the British Isles
DRUMMOND - ASQUITH LIMITED
Member of the Asquith Machine Tool Corporation

KING EDWARD HOUSE, NEW ST., BIRMINGHAM *Phone: Midland 3431. Also at LONDON Phone: Trafalgar 7224 & GLASGOW Phone: Central 0922*

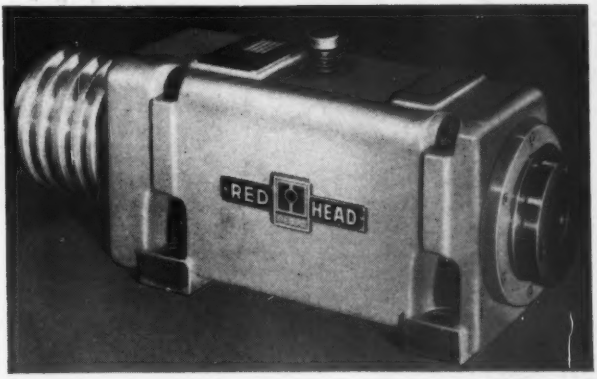
A 467

HERE'S HOW HEALD BOREMATICS maintain OUTPUT

Simple, foolproof hydraulic system by means of a core plate supporting separate valve units. Cored passages eliminate yards of piping and fittings—greatly simplify maintenance.



Permanently lubricated boring heads designed for cool running, obviate need for maintenance. 100% inspection of super-precision bearings ensures accurate performance and long life.



Maintenance costs further reduced by:

- Automatic lubrication throughout.
- Separate hydraulic power unit easily removed.
- Built-in guarding to protect slides and control chips and cutting fluid.

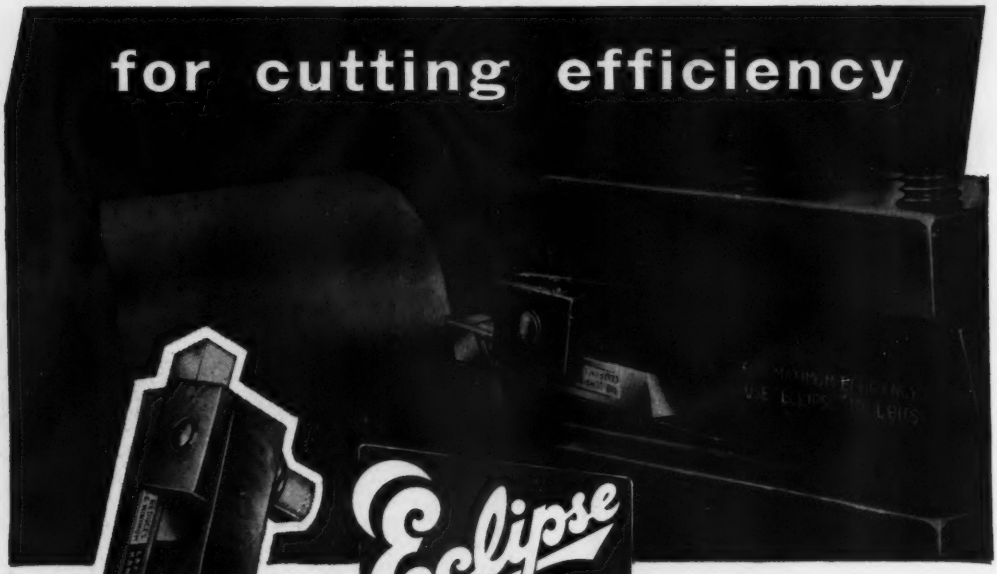
You'll find IT PAYS to come to—

HEALD

HEALD MACHINES LIMITED · BIRMINGHAM 24 · ENGLAND

Sales Representatives: **ALFRED HERBERT LIMITED · COVENTRY**

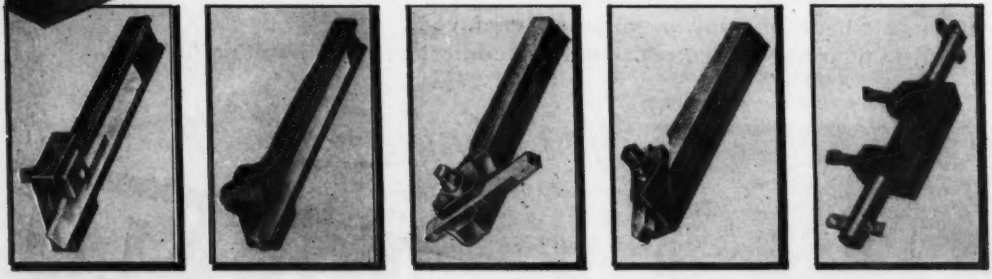
for cutting efficiency



Eclipse

tool bits, lathe tools and tool holders

"Eclipse" tool holders are manufactured with the utmost care from high quality materials, are carefully heat treated and incorporate a number of special features which enable them to do their job superbly well. To complete the list of tools for turning and metal cutting, there is also the extensive range of "Eclipse" tool bits and lathe tools. Made from "Eclipse" H3 Cobalt High Speed Steel, these tools are carefully heat treated to give the perfect combination of hardness and toughness—tools which can be relied upon to maintain a keen cutting edge.

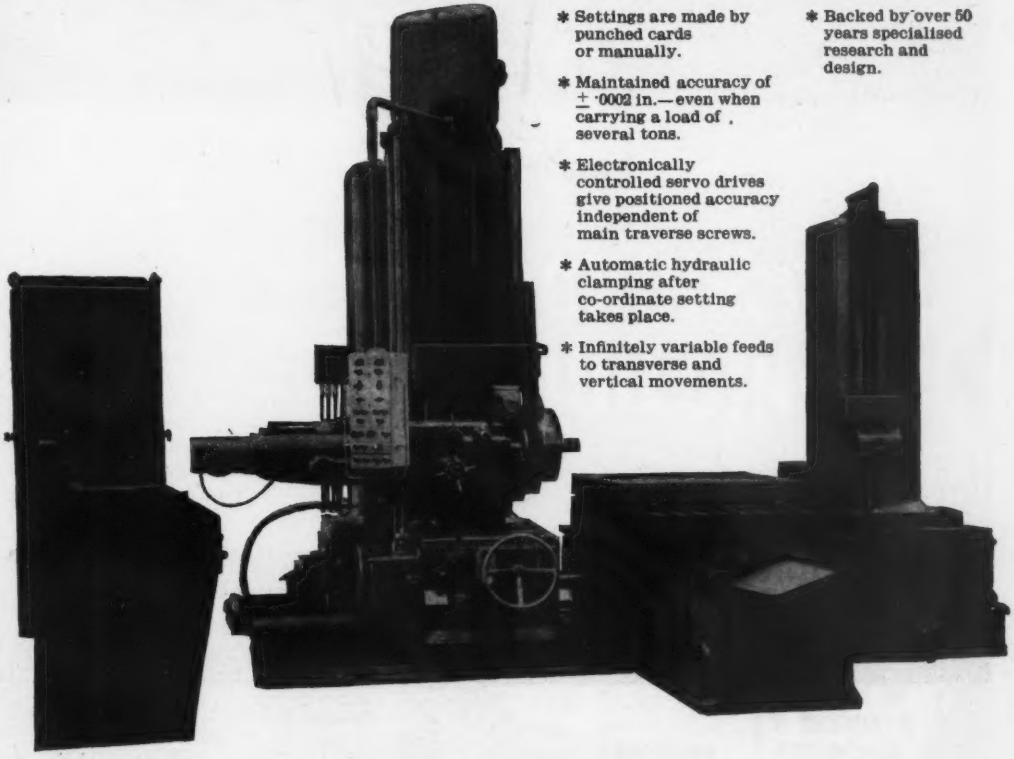


MADE BY
James Neill & Co. (Sheffield) Ltd., and obtainable from all tool distributors

UT19

A NEW MODEL...
in the Kearns range of universal horizontal boring machines with A.E.I. electronic control...

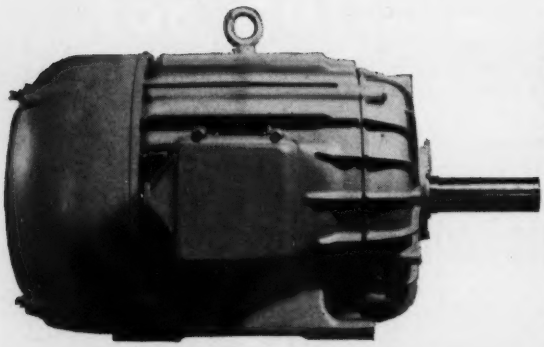
* MODEL 451P planer table type electronic universal horizontal surfacing, boring, milling, drilling, tapping and screwcutting machine



* Settings are made by punched cards or manually.
* Maintained accuracy of ± ·0002 in.—even when carrying a load of several tons.
* Electronically controlled servo drives give positioned accuracy independent of main traverse screws.
* Automatic hydraulic clamping after co-ordinate setting takes place.
* Infinitely variable feeds to transverse and vertical movements.
* Backed by over 50 years specialised research and design.

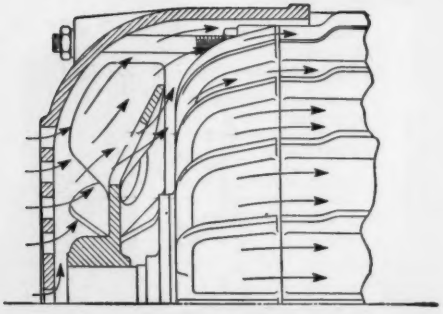
* another Kearns development for improved production efficiency

H. W. KEARNS & CO LIMITED BROADHEATH near MANCHESTER



Engineers use the word performance in two senses, a limited one which refers to parameters that can be specified and checked, and a wider, vaguer, but essentially more realistic sense which covers reliability, freedom from trouble, ease of servicing, ready adaptability and many other things. Performance in the first sense is reproducable by any competent manufacturer; it depends on designing to well established principles. Performance in the second sense is the basis of choice between manufacturers. It comes from countless small differences in design that are based on...

This thing called know-how



Take the cooling of a T.E.F.C. motor which is more complex than it looks. The combination of fan and cowl must produce a high velocity airstream that remains close to the stator frame over its entire length, scouring any dead air tending to cling to the ribs. This has been successfully achieved on our new 'KD' range of motors to B.S.2960: Part 2: 1960 resulting in a minimum temperature difference between one end and the other. The fan that does it is worth attention. It is double bladed and the blades on the inner side direct air over the endshield. The scrubbing effect of this air ensures effective cooling of the endshield at the non-driving end.

Crompton Parkinson LIMITED

ELECTRICAL EQUIPMENT

Makers of Electric Motors of all kinds, A.C. and D.C. Generators, B.E.T. Transformers, Switchgear, Cables, Instruments, Lamps, Lighting Equipment, Batteries, Stud Welding Equipment, Traction Equipment, Ceiling Fans.

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BIG
PEOPLE
for
MACHINE TOOL
REBUILDING
are...
Newman
OVER A
QUARTER OF
A CENTURY'S
EXPERIENCE
NEWMAN INDUSTRIES LIMITED
YATE · BRISTOL · ENGLAND
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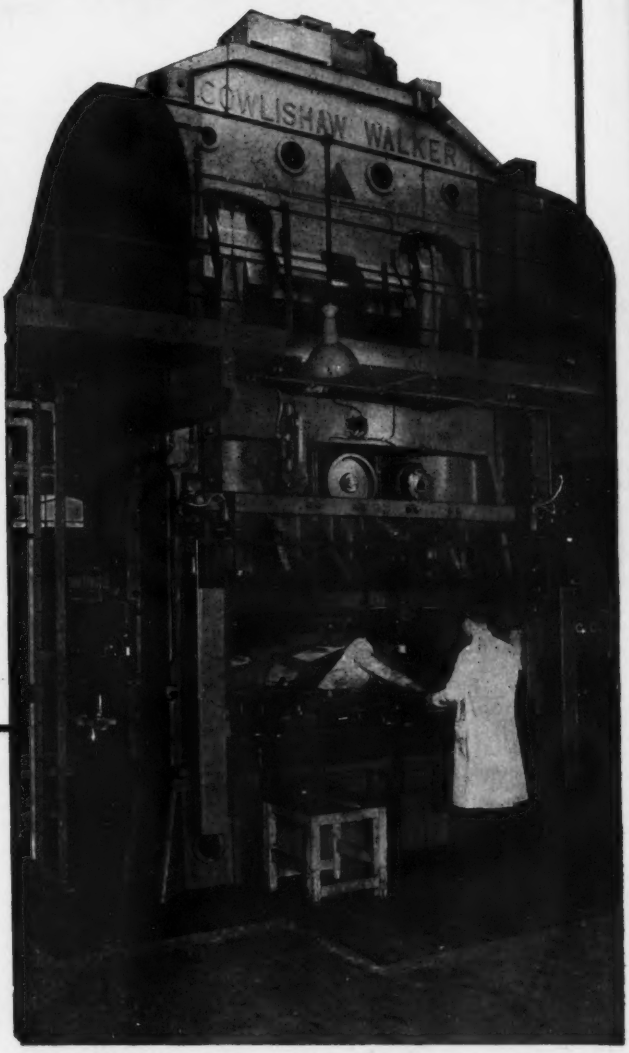
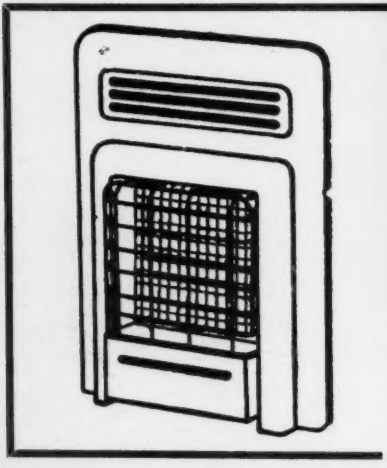
COWLISHAW WALKER

400 TON PRESS



Producing outer casings for the famous range of Bratt Colbran gas fires at their Wembley works.
This advanced and highly efficient design of gas fire sends convected warm air to every corner of the room in addition to the normal radiant heat.



COWLISHAW WALKER PRESSES with their fine craftsmanship and inbuilt dependability have that extra frame and slide rigidity which guarantees better pressings and longer tool life.

COWLISHAW, WALKER & CO., LIMITED

Telephone: Biddulph 3254 **BIDDULPH · STOKE-ON-TRENT** Telegrams: Cowlishaw, Stoke-on-Trent

LONDON OFFICE: 117 Victoria Street, Westminster, London, S.W.1. **Telephone: VICtoria 5472.**

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Machinery 7
May 3 1961

ABWOOD

HIGH PRECISION

TOOL & DIE SURFACE GRINDER

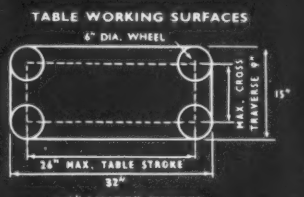
MODEL SG-4H

HYDRAULICALLY OPERATED

RAPID POWER ELEVATION OF KNEE

HIGH PRODUCTION WITH VERSATILITY

SENSITIVE CONTROLS WITH RUN OUT TO LOADING POSITION



- Automatic in-feed for depth of cut in .0002in. steps.
- Pressure lubricated completely covered slideways.
- Hydraulic reservoir and pump housed in base.
- Large capacity mobile coolant tank with removable sludge tray.
- Segmental chuck available for maximum stock removal.
- Built to Schlesinger limits.
- Finishes to 1.5 micro inches on suitable materials.
- Manual table traverse for use with Cutter Grinding Attachment.

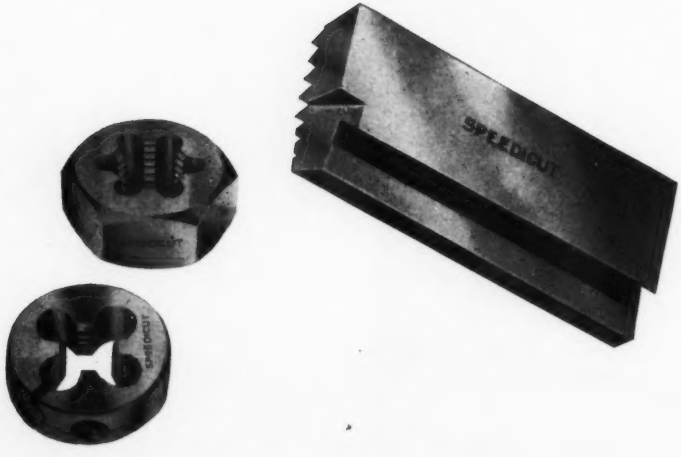
ABWOOD MACHINE TOOLS LTD., PRINCES ROAD, DARTFORD, KENT

Telephone: Dartford 25271 (5 lines)

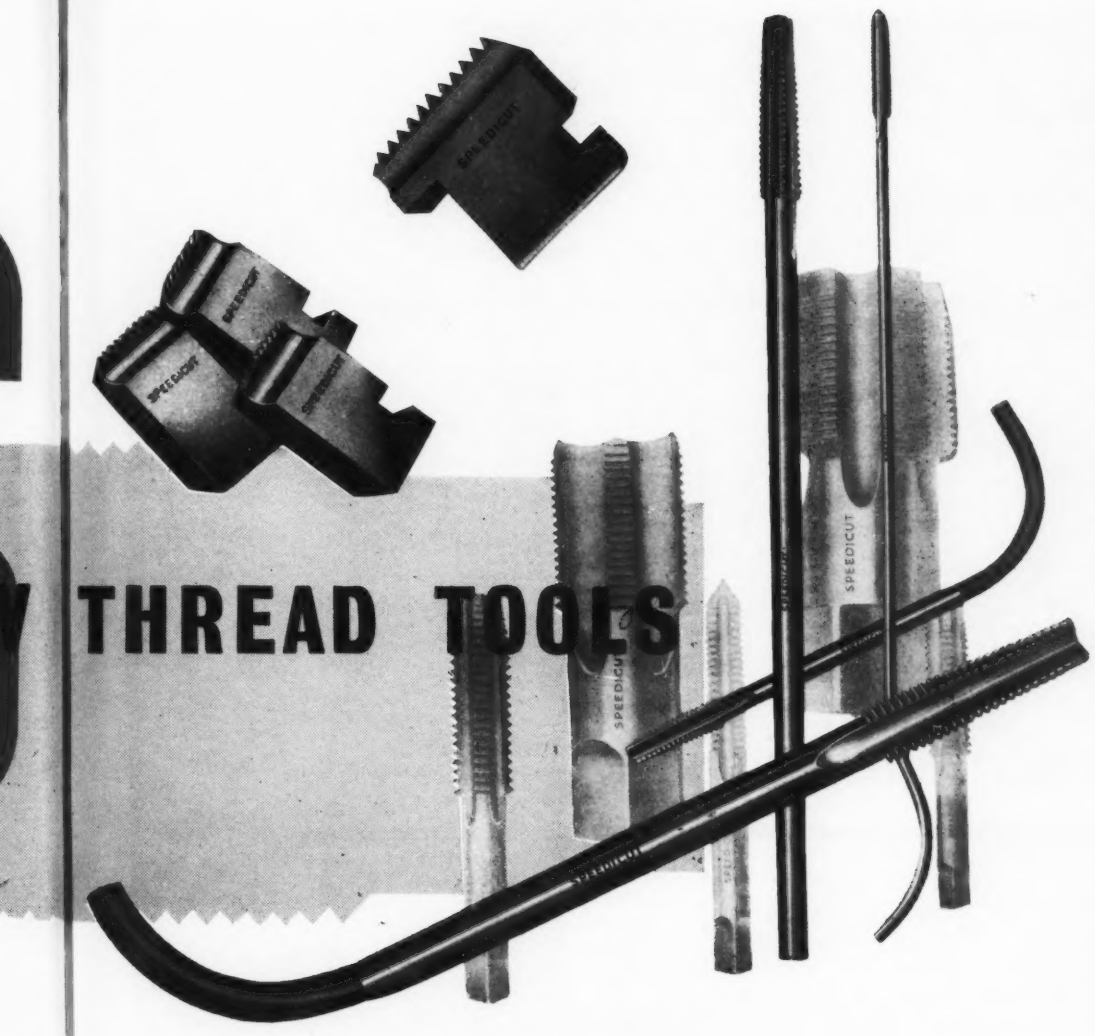
Telegrams: ABWOOD DARTFORD

SPEEDICUT

TAPS & SCREW T



FIRTH BROWN TOOLS LIMITED



THREAD TOOLS

Speedicut Taps, working at a peripheral speed of 150 ft. per minute, give the remarkable cutting time of 1·2 seconds for a ¼" B.S.F. nut. The tap life on 28/32 tons tensile steel nuts is 40,000/60,000.

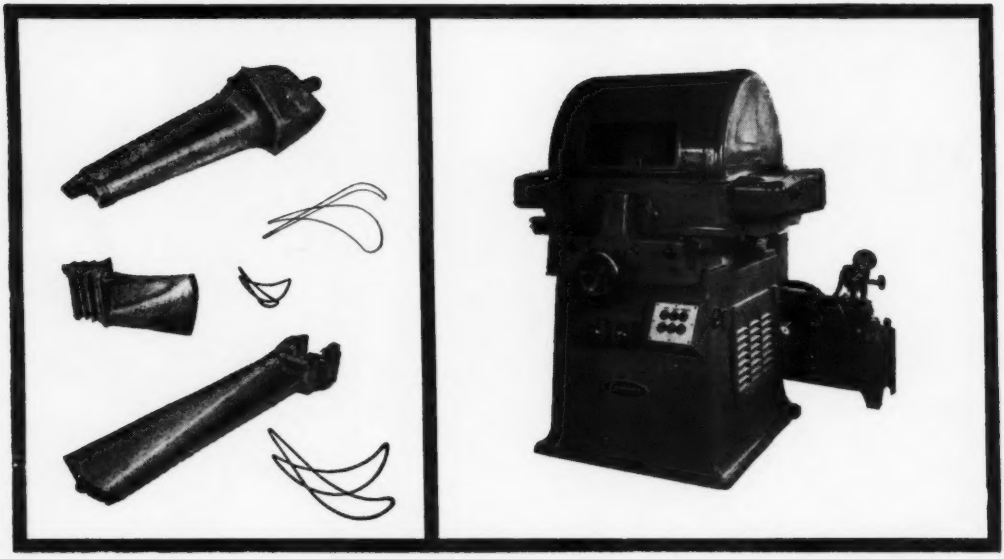
Take advantage of latest techniques in toolmaking

SPECIFY SPEEDICUT.

SPEEDICUT WORKS · CARLISLE ST. EAST · SHEFFIELD

Cadamco

The only precision copy belt grinding machine in the world to reproduce any shape of turbine blade



- Automatic machine cycle—one operator can control a bank of machines
- Accurate to ± ·002 in.
- Currently operating throughout the British turbine industry

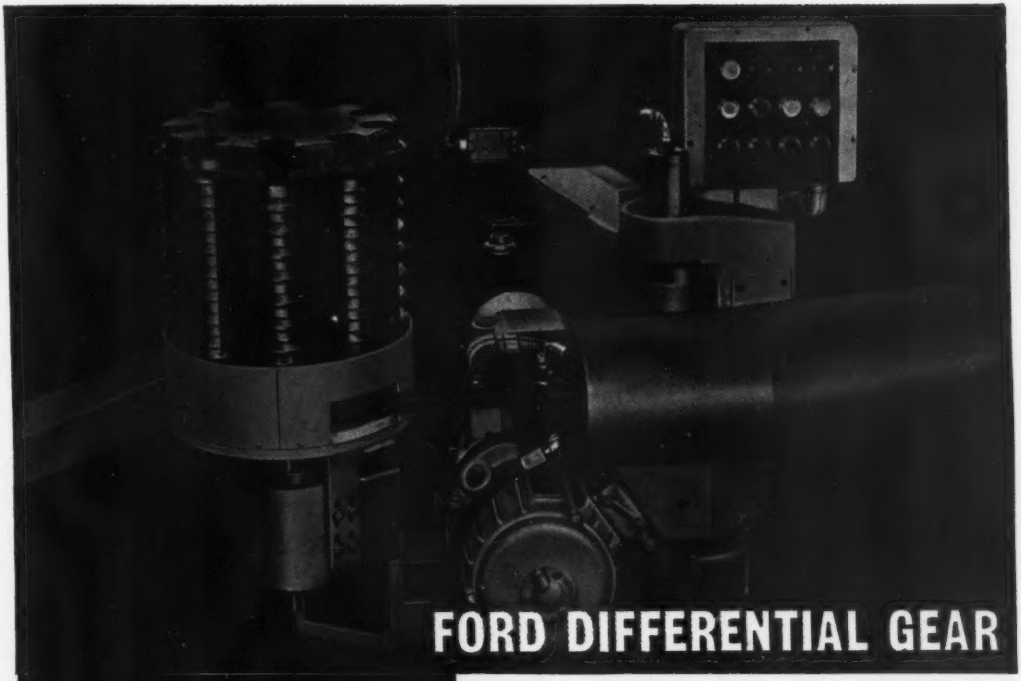
CYRIL ADAMS & CO. LTD.,

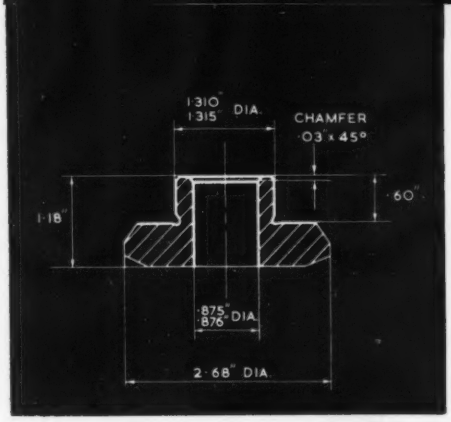
155 East Barnet Road, New Barnet, Hertfordshire
Telephone: Barnet 2335/6/7

Designers and Manufacturers of Jigs, Fixtures and Special Purpose Machine Tools

Member of the Staveley Coal & Iron Co. Limited Group of Companies, in association with James Archdale and George Richards

Member of the Machine Tool Trades Association





MACHINED IN 24 SECONDS WITH AUTOMATIC LOADING

The photograph shows the automatic loader fitted to a No. 6 Ryder Verticalauto supplied to The Ford Motor Company Limited. It is used in the production of differential gears, which are finish-bored, turned and faced at the rate of one component in 24 seconds. The magazine carries enough components for a forty minute run.

Automatic loading can be fitted to all sizes of Ryder Verticalautos.

Ryder

VERTICALAUTO

Thos. Ryder & Son, Limited, Turner Bridge Works, Bolton, England.
Makers also of single spindle Rydermatics and Piston Ring Lathes.

ATTRACTIVE PRICE

Tipped with Veraloy, the only hot pressed and vacuum sintered cutting tip in the world

Write for particulars to :—

VERALOY

VERALOY PRODUCTS LIMITED

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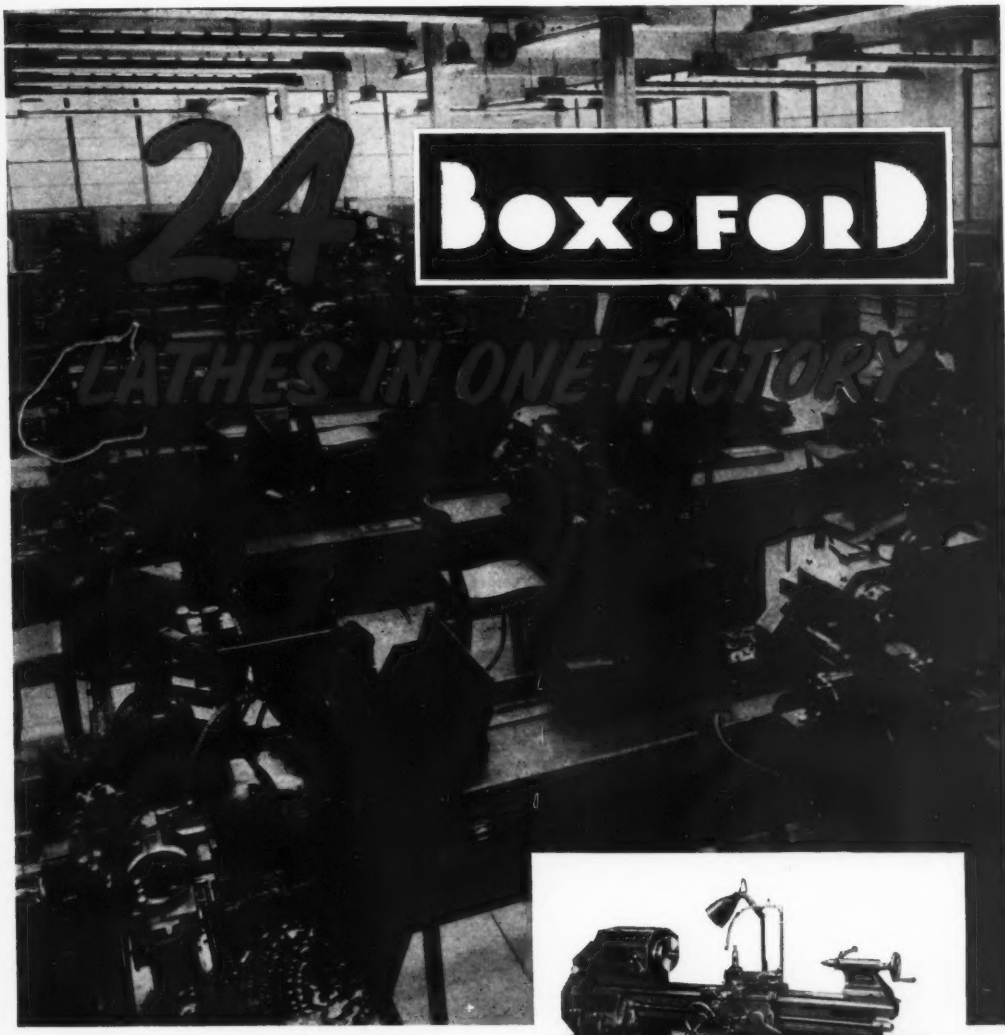
Telephone: High Wycombe 2795-8. Telegrams: Veraloy High Wycombe



Courtesy: Messrs. Muirhead & Co. Ltd., Beckenham, Kent.

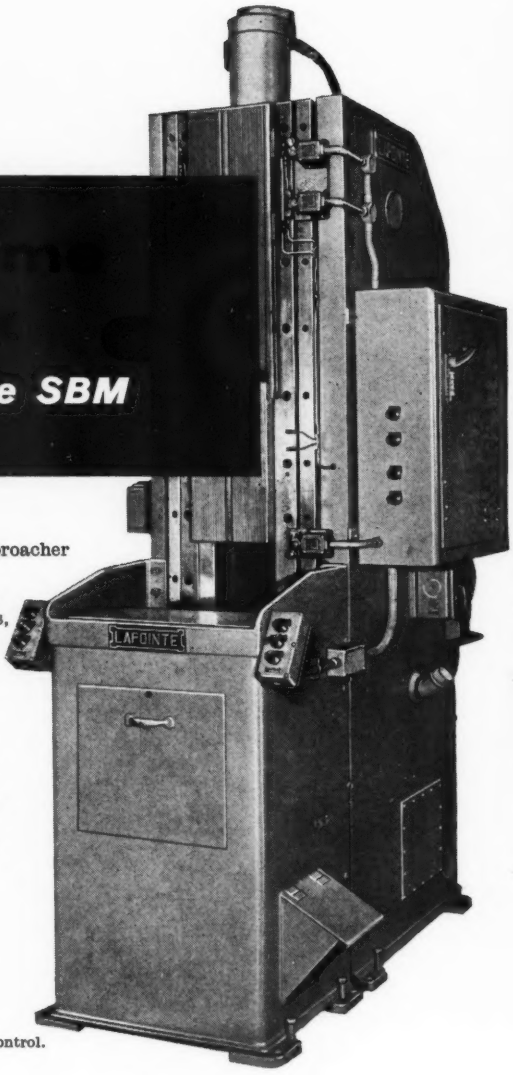
A tribute to the outstanding quality of "BOXFORD" Lathes is seen in this installation at Messrs. Muirhead & Co. Ltd. "BOXFORD" Lathes give full support to the skill of their operatives on work of the highest precision.

Model AUD with Norton type gearbox and automatic apron—one of the latest BOXFORD lathes.

Literature available covers the complete BOXFORD range of Lathes for training and light production.

DENFORDS ENGINEERING CO. LTD. BECKMONDWIKE, YORKSHIRE

Put idle time to work ... with the Lapointe SBM



This low-cost Lapointe surface broacher shortens the gap between the end of one run and the start of another. Push button controls, automatic lubrication and other typically Lapointe features make it ideally suited for small or large batch production . . . make it the best value machine in its class. The SBM typifies the engineering skill and design that go into every Lapointe machine. Best results are obtained when equipped with Lapointe-designed fixtures and tools.

SBM Surface Broaching Machine
Stroke sizes 24", 36", 48".
Standard equipment includes
Hydraulic Pump, Flexible Coupling,
Motorised Coolant Pump,
Automatic Lubrication, Push Button Control.

come to LAPOINTE for better broaching

British Made

The Lapointe Machine Tool Co. Ltd

Otterspool Watford By-Pass Watford Herts
Watford 31711 (4 lines) Cables: Lapointe Watford
Subsidiary: Lennie & Thorn Limited Bracknell - Berkshire
also The Lapointe Machine Tool Company Hudson Mass. USA

Among the most prized possessions
of resourceful engineers—**QUALCUT TOOLS**

QUALCUT TOOLS LIMITED, HANDSWORTH RD., SHEFFIELD 13. TEL: SHEFFIELD 49371/6

* IMPROVED PITCH SELECTION
* INCREASED PITCH ACCURACY
* REDUCED HANDLING TIMES

ON

PRECISION LATHES
WHEN

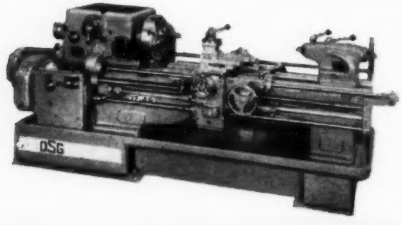
MULTI-START & COARSE PITCH THREADING

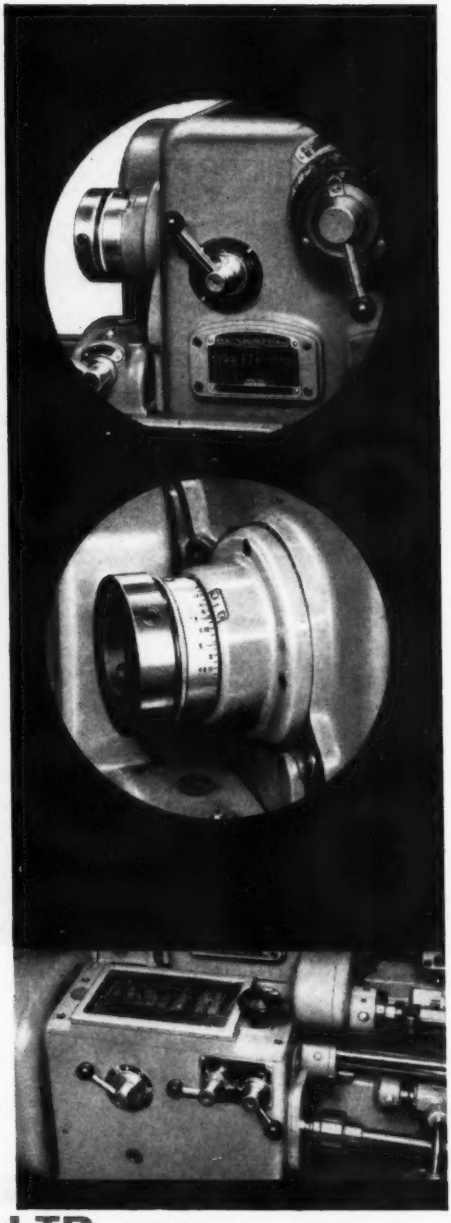
Each size of lathe in the D.S.G. range incorporates a totally enclosed screwcutting Gearbox, providing the means for rapidly selecting thread pitches.

The Headstock is fitted with a feed increasing device for coarse pitch threading.

The lathe spindle is fitted with an indexing dial which indicates the precision indexing obtained from a ground divider in the Headstock. This dial is standard equipment on TYPES 13-1 and 17 Toolroom lathes.

WHEN MULTI-START AND COARSE PITCH THREADING, THE COMBINATION OF THESE FEATURES ENSURES THAT ALL THE ABOVE ADVANTAGES ARE OBTAINED.





DEAN, SMITH & GRACE LTD. KEIGHLEY, ENGLAND

Telex No. 51-123 · Telegrams: LATHES Keighley
Tel. No. 5261 (7 lines)

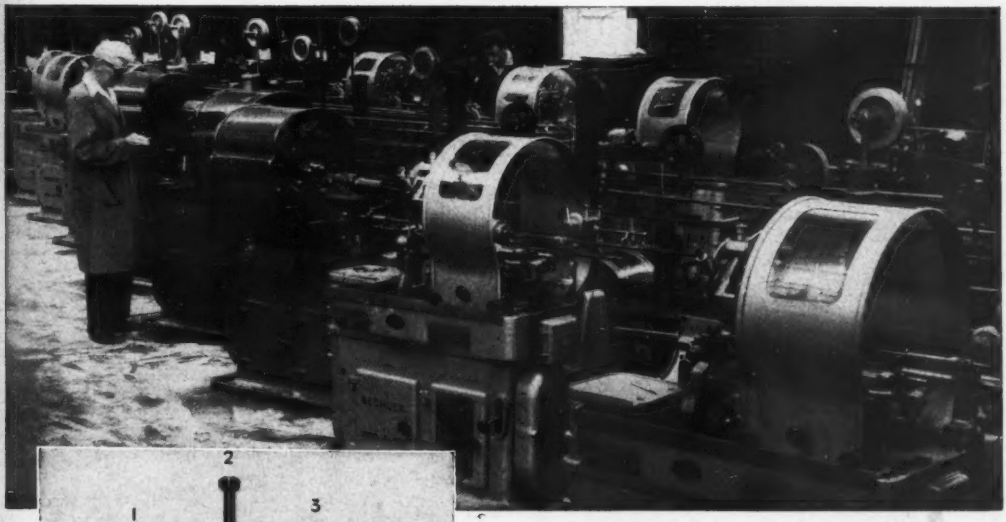
Manufacturers of
13-30" Swing Engine Lathes
Surfacing and Boring Lathes
Toolroom Lathes

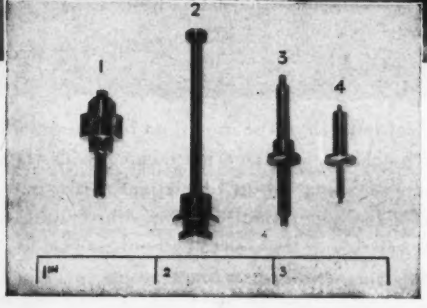
—for over thirty years

BECHLER AUTOS

have been in use on precision machining of small watch and instrument parts at—

ROTHERHAM & SONS LTD.
COVENTRY





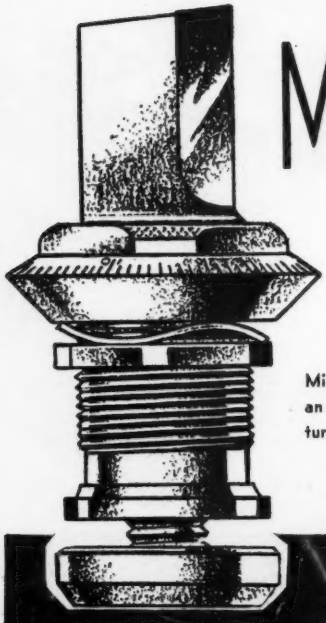
Some of the twenty-five Bechlers which are in continuous operation at the Coventry Works of Rotherham & Sons Ltd.

Typical examples of stainless steel components being machined. Production of items, 1, 2, 3 and 4 is 40, 48, 17 and 60 per hour respectively. A high quality finish is required on all these components.

Four types and nine sizes of Bechlers are available for producing the smallest watch parts and for work up to 1¾" diameter × 8½" long. Simple or complex work can be produced at high rate production.
Range of machines also available fitted with six-spindle revolving turret which reduces idle time to the minimum.

ALFRED **HERBERT** LTD., COVENTRY Factored Division, Red Lane Works.

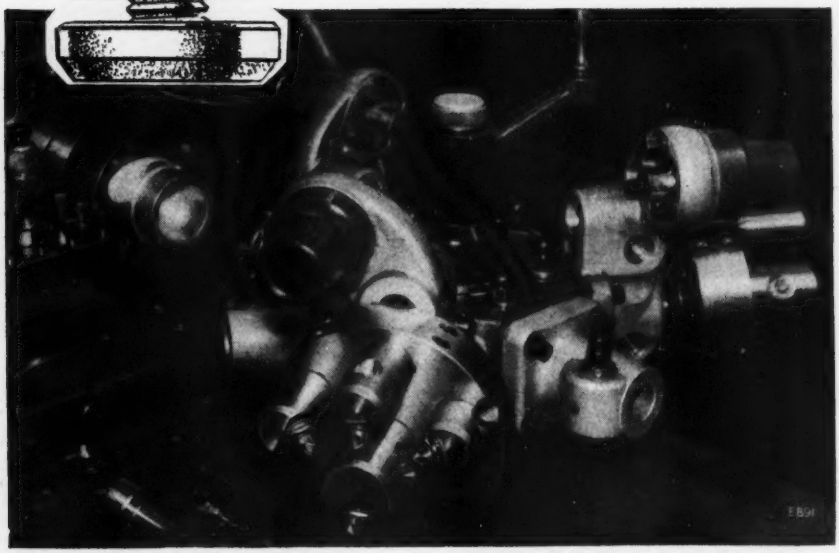
AD.487



MICROBORE

precision tooling

Microbore tooling set-up on a Herbert No. 2D capstan lathe for machining an aluminium alloy component in a total time of 60 seconds. Five diameters turned, faced and bored simultaneously using cluster tooling.



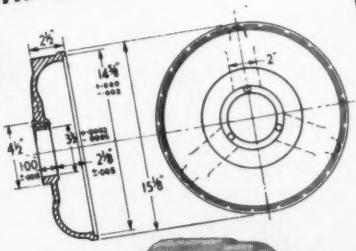
The Microbore eliminates trial-and-error methods of setting a single-point cutting tool for precision machining on lathes and boring, drilling and milling machines. Grouping these units, as illustrated, provides all the advantages of a specially-designed multi-tooling set-up but is inexpensive and is extremely flexible. Each cutting edge can be independently adjusted to micrometer precision, is easily replaceable and can be independently ground. Microbore Units or complete bars for specific set-up supplied. Six types and fifty sizes of Units available.

ALFRED **HERBERT** LTD., COVENTRY Factored Division, Red Lane Works.

AD.483

turned, bored, faced, recessed, reamed and DRILLED in one set-up; floor-to-floor time 6½ minutes on a

HERBERT No 5A AUTO-LATHE



For high-production repetition work with consistent accuracy.

Greatest output per foot of floor space at lowest labour cost per piece — one operator and one tool setter can keep from four to six machines in continual operation.

Power, rigidity and speed ranges to take full advantage of Ardoloy and other carbide tooling.

All operations except chucking and removing the work are entirely automatic.

Herbert Auto-lathes are made in five sizes: Auto Junior — 8¼" swing, No. 3A — 12¼" swing, No. 4 — 16¼" swing, No. 5A — 25" swing and No. 5A — 33-33¼" swing.

Available for Early Delivery

Send now for brochure "Production on Herbert Auto-Lathes."

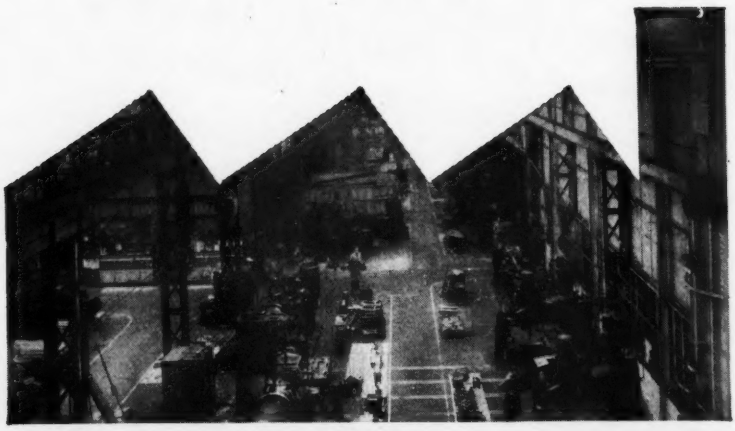
ALFRED HERBERT LTD., COVENTRY

AD 590

When answering advertisements kindly mention MACHINERY.

B2

THERE'S PLANT CAPACITY AT CARRON



It pays to use the production resources of Carron Company. 250 acres of plant for casting, forging, machining, enamelling and sheet metal fabrication are on call to manufacturers who find it uneconomic to tool up for the special job. The technical advisory service of Carron is ready at all times to help iron out production problems.

Consider this plant capacity for medium heavy machining: planing, vertical and horizontal boring mills; milling and drilling of work up to 5 tons; moulding and machining capacity for non-ferrous components up to 5 cwts., including high speed routing and precision milling. Fabrications, too, light and heavy gauge, stainless steel, press tools, welding. From small light gauge sheet metal to large plate welded fabrications, Carron can quote.

CARRON

CARRON COMPANY · CARRON · FALKIRK · SCOTLAND

Telephone: Falkirk 35

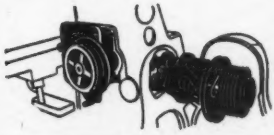
LONDON: 15 Upper Thames Street, E.C.4	*Telephone: CENtral 7581*
LIVERPOOL: 22-26 Redcross Street, 1	*Telephone: CENtral 1945-6*
GLASGOW: 125 Buchanan Street, C.1	*Telephone: CENtral 8226*
NEWCASTLE UPON TYNE: 33 Bath Lane	*Telephone: 26940*

World-beating value

A&S MODEL 2 AGU

UNIVERSAL MILLING MACHINE

This machine represents outstanding value in universal millers, especially when you consider the high quality built into it. Ideal for tool-room use or short production runs. Unbeatable for consistent precision output with absolute minimum of maintenance or trouble. Only by omitting all unnecessary features can we produce this fine, heavily-built machine so inexpensively.



UNIT CONSTRUCTION—Maintenance is much simplified by the provision of self-contained units for the speed change mechanism and the spindle gear-box. These are flange mounted and easily withdrawn for servicing.

TABLE

Working surface 40" x 10"
Traverses—23" longitudinally—
7½" transversely—14½" vertically
Angular displacement of table—
47 degrees either side

MOTOR

Choice of single speed or two-speed 4 or 4/5 H.P.

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Easily read dial system for rapid selection of spindle speeds:
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Selection and engagement by two levers. 9 feed rates, from ¼" to 10" per min., or with 2-speed motor, 12 feed rates from ½" to 20" per min.

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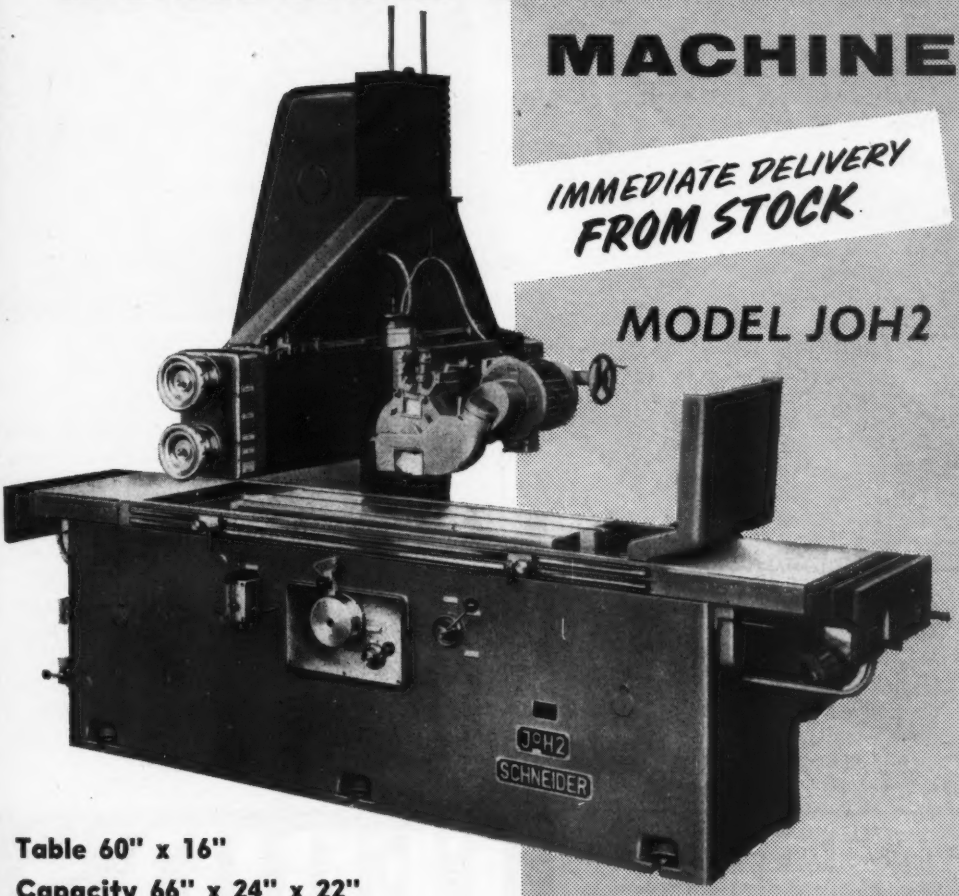

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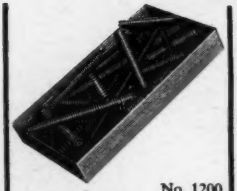

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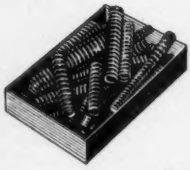

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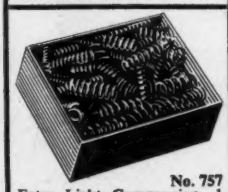

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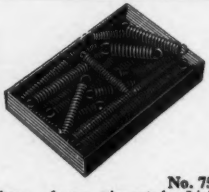

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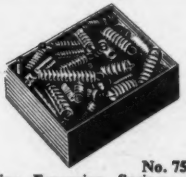

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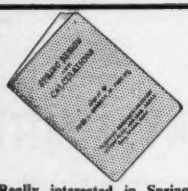

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* Flame hardened and ground bed ways
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Height of centres	8"
Distance between centres	54"
Swing over cross slide	10"
Spindle speeds (16)	28—1200 r.p.m.
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Motor	5 h.p.

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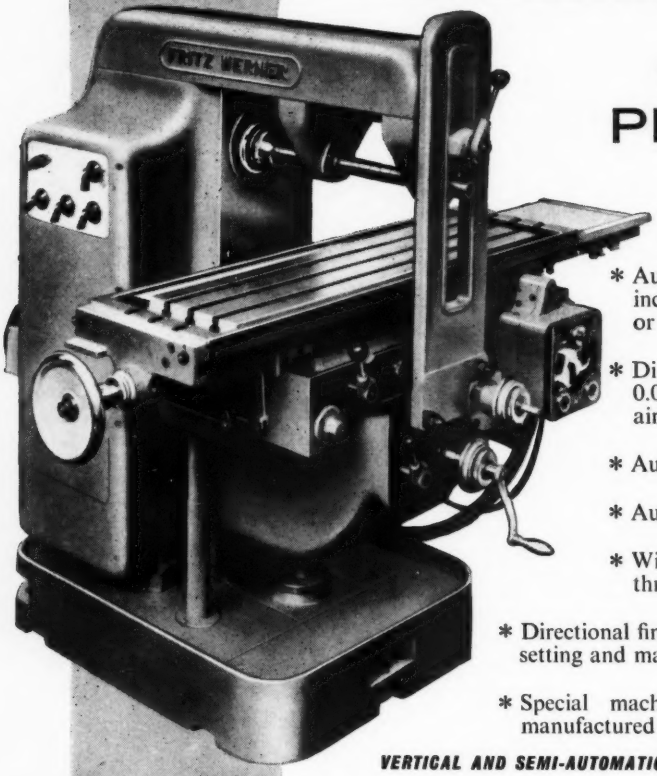

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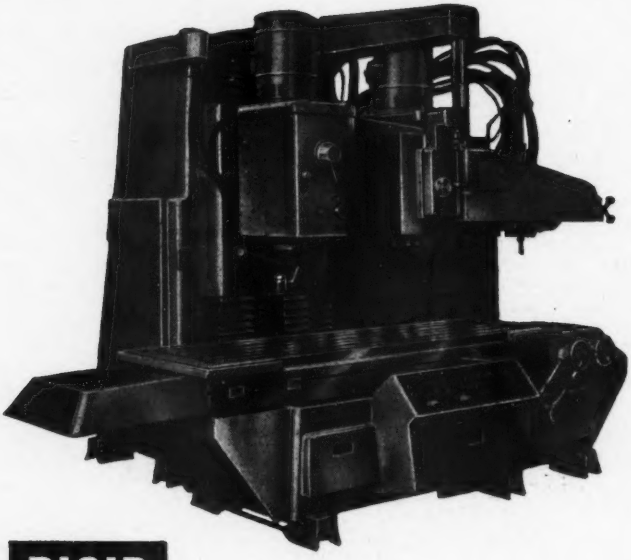

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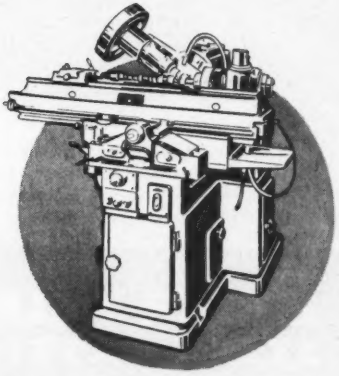

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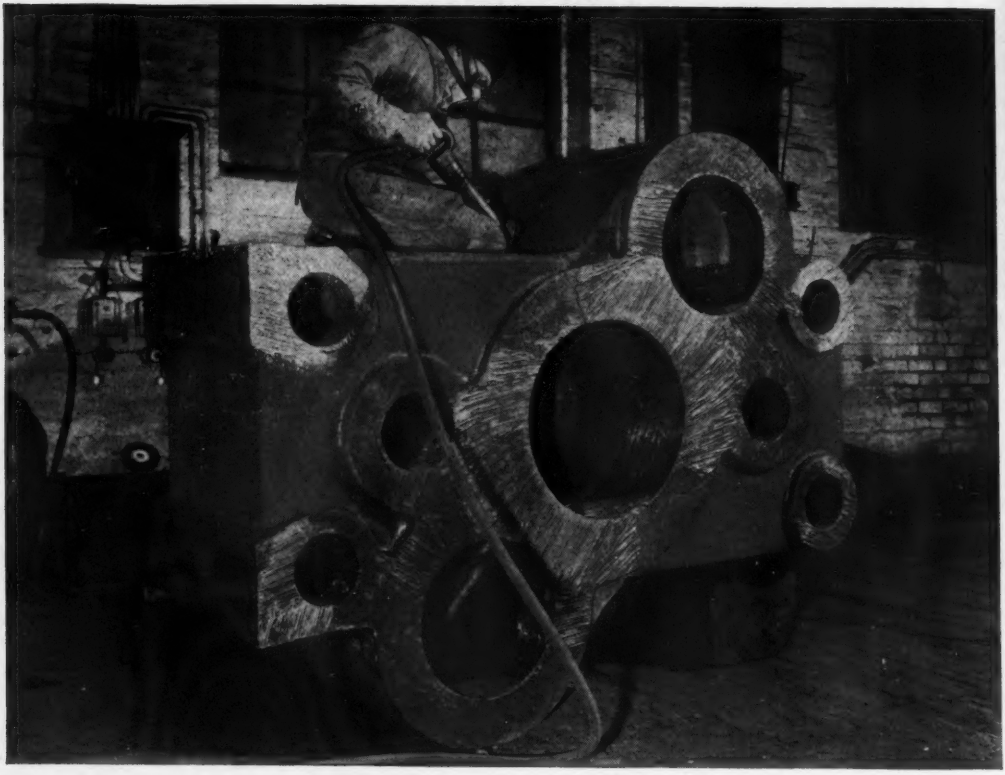

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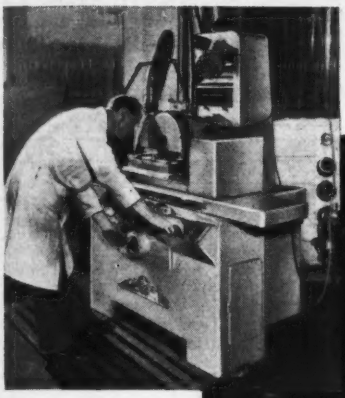
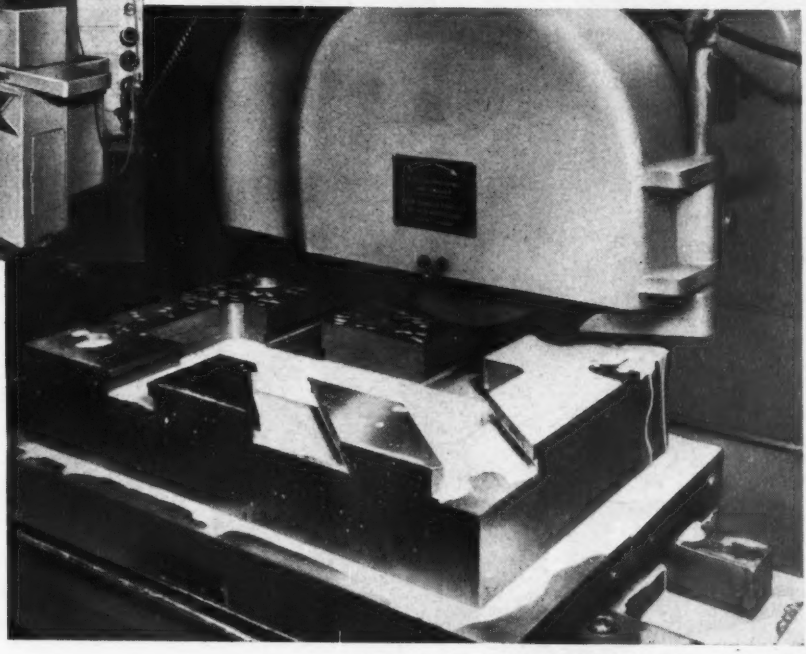


Grinding die-casting dies at Talbot-Ponsonby & Co. Ltd.



On the ELB Model SW6 VA1 Surface Grinder

Photographs by courtesy of Talbot-Ponsonby & Co. Ltd.

Grinding the parting faces of large pressure die-casting dies and moulds is an exacting job and one which the ELB Model SW6 Surface Grinder, installed at the Talbot-Ponsonby Works in Petersfield does particularly well. But then ELB machines must grind flat and parallel, as there is no compound table to sag or get out of alignment and the cross moving column travels on its own bedways at the rear of the machine.

The enormous success of ELB Surface Grinders is borne out by the fact that over 2,000 have been purchased during the past eight years and that the range is now probably the largest in the world, with no less than 19 sizes and 51 basic models, equipped with horizontal or vertical spindles or both. In addition, there are combined machines incorporating jig boring and jig grinding heads, spark-erosion and electrolytic Grinding machines and a range of Slideway Grinders of unsurpassed accuracy. A new 90-page Catalogue describing these machines and the vast range of equipment available with them is in preparation. Please reserve your copy now.

You, too, should investigate ELB full-face, wide-wheel grinding

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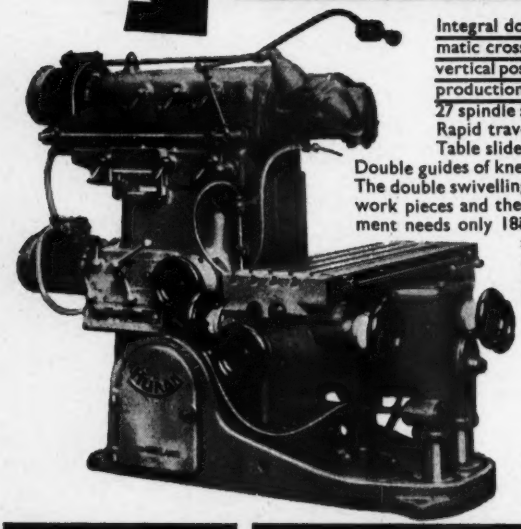

Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from $\frac{1}{16}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39⅜in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56⅛in. × 15⅜in.	43½in.	27½in.	19⅜in.
KU5	64⅛in. × 15⅜in.	51½in.	27½in.	19⅜in.
KU6	78⅜in. × 16½in.	59in.	27½in.	19⅜in.
KU55	64⅛in. × 26in.	51½in.	38⅜in.	18 $\frac{7}{16}$in.
L83	157in. × 59in.	118in.	39⅜in.	59in.

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

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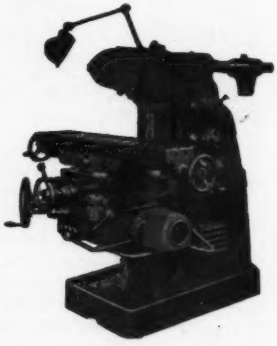
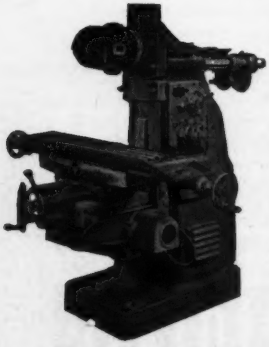
WITH DOUBLE UNIVERSAL SWIVELLING HEAD, RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18⅜in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ⅛-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds $\frac{1}{16}$-23⅜in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43½in. × 9⅛in.	27½in.	9⅛in.	15⅜in.
61	47½in. × 10⅜in.	30⅜in.	9⅛in.	15⅜in.
59	51 $\frac{7}{16}$in. × 11⅜in.	34⅜in.	11 $\frac{13}{16}$in.	21 $\frac{7}{16}$in.
54	67in. × 14⅛in.	43⅜in.	14⅛in.	20⅜in.

Send for full particulars of our very extensive range of these machines; ask for demonstration.

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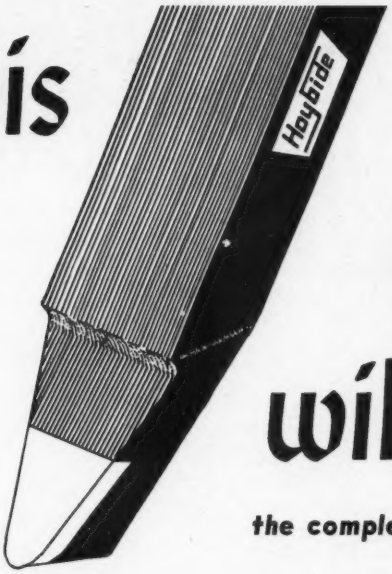

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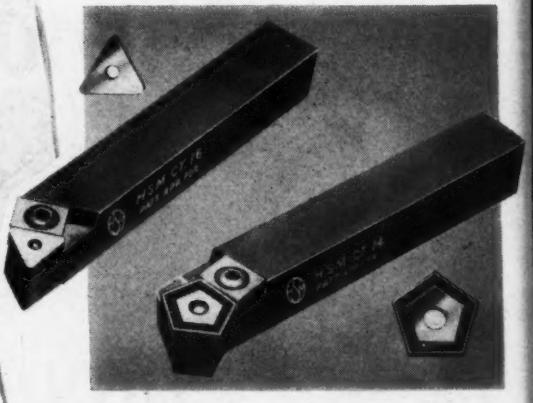

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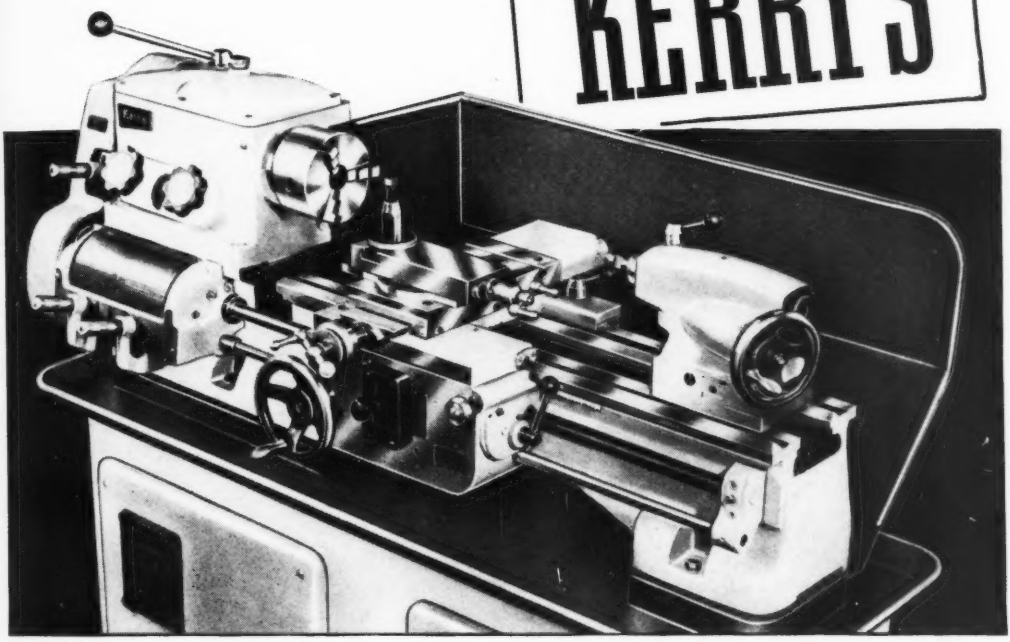

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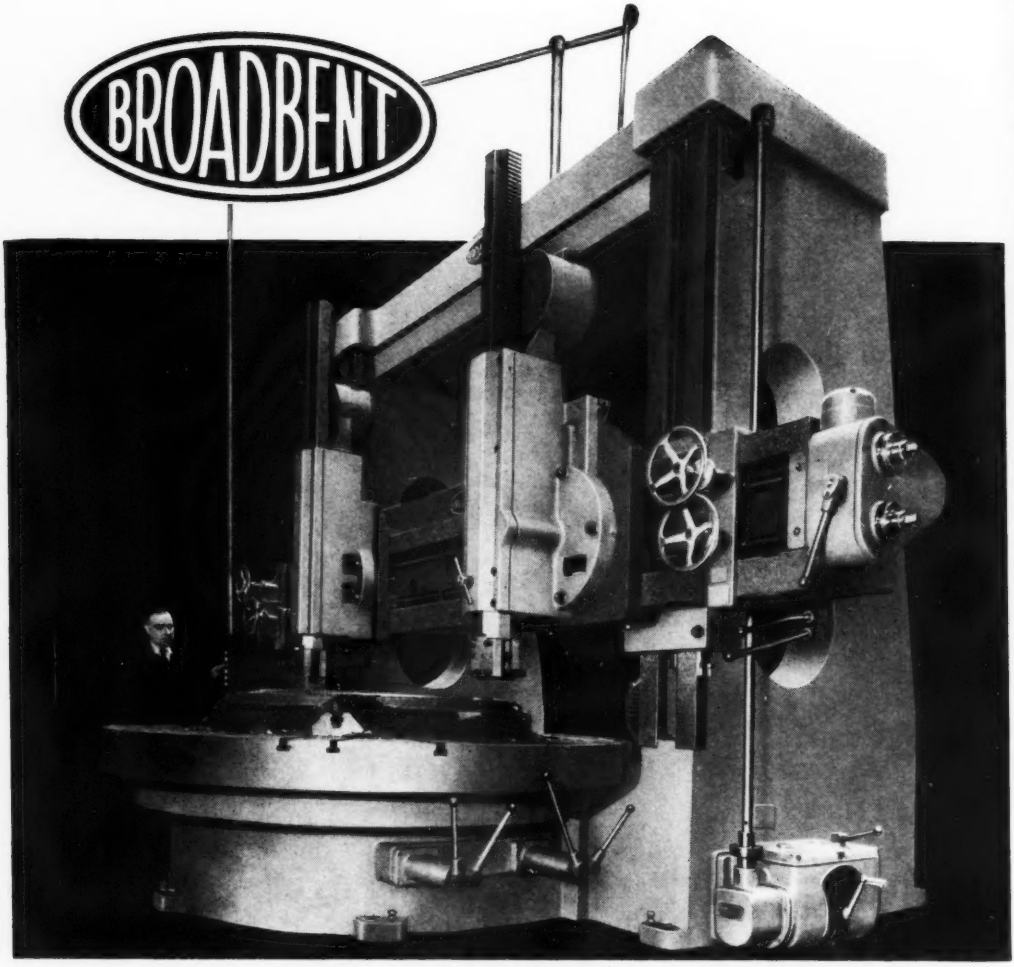

HEAVY DUTY Vertical BORING & TURNING MILLS

with 5, 6, 8 or 10 ft diameter work tables

These incomparable machines are massively constructed for years of hard service. Accuracy and dependability are of the high order that industry has learned to expect of Broadbent Machine Tools. Notable features of these Boring and Turning Mills include twelve changes of speed and six changes of feed, controllable from either side of the machine; spiral bevel and spur reduction gears driving the work table; pendant control of rams and cross slides; and rapid power traverse with independent control of the two heads.

Please write for fully illustrated brochure.

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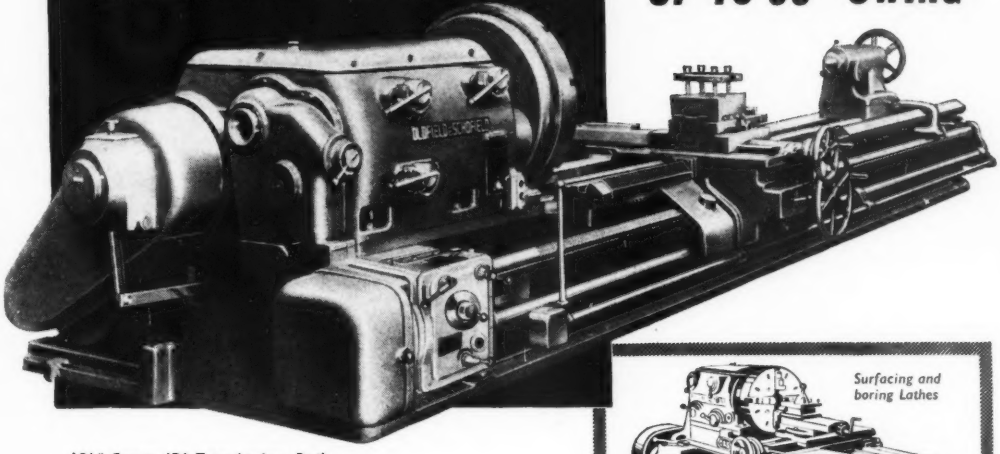
Sales Office: WARTON ROAD, STRATFORD, LONDON, E.15. Telephone: MARyland 6611

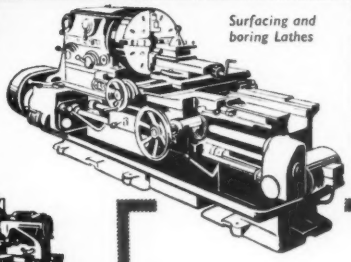
Broadway/HB8

Heavy Duty LATHES

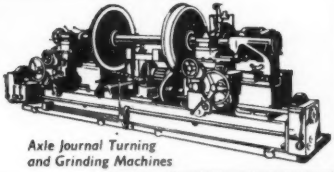
UP TO 96" SWING



18¼" Centre 'D' Type Lathes. Built in sizes up to 48" swing.

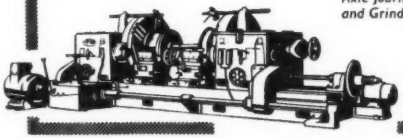


Surfacing and boring Lathes



Axle Journal Turning and Grinding Machines

Heavy Duty Double Wheel Lathe



O & S have for many years manufactured a wide variety of heavy lathes which have earned for the company a fine reputation for precision engineering and first class craftsmanship. The range includes Surfacing and Boring Lathes up to 96" swing, Brake Lathes, Axle Lathes, railway carriage and waggon wheel lathes, axle journal turning and burnishing lathes etc., all embodying the latest developments in modern lathe design.

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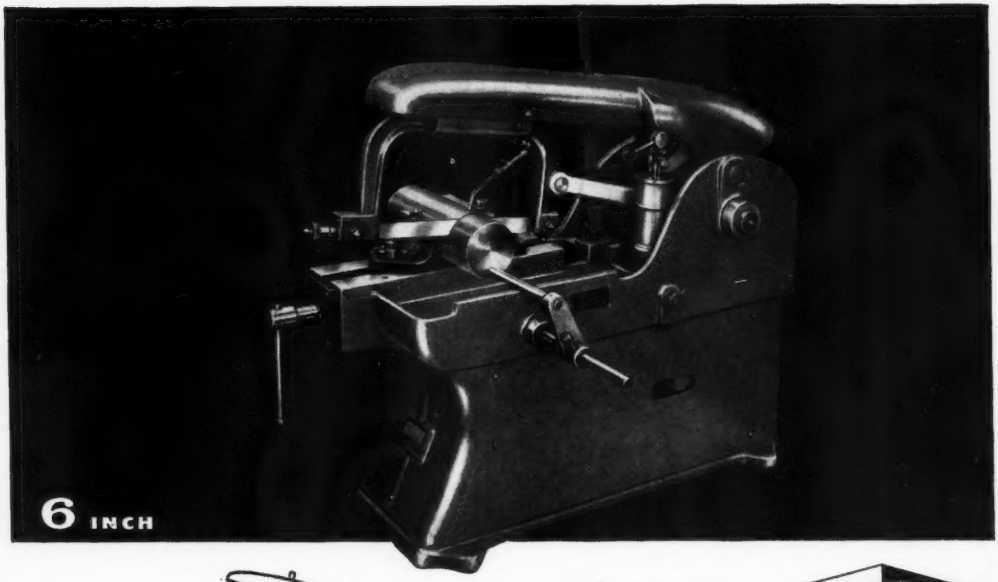

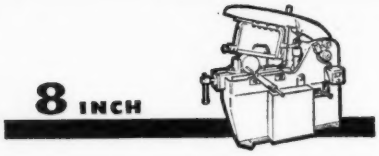

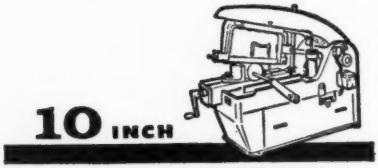

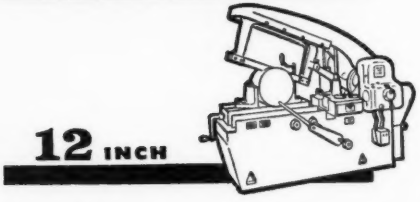

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SAWMASTERS

are the finest HEAVY DUTY HACKSAWS in the world

Modern in design, robust and precise in construction, these unrivalled machine saws cut accurately and rapidly, and offer maximum production efficiency. Refinements include totally enclosed drive, hydraulic relief on the return stroke and automatic lifting of the bowslide to loading position on completion of cut.

Instant lever selection of correct cutting speed is a feature of all but the smallest model.

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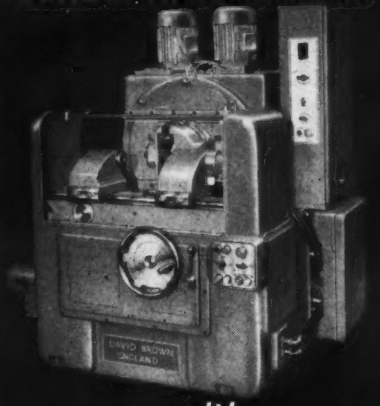
David Brown MACHINES



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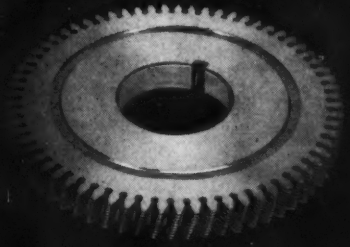

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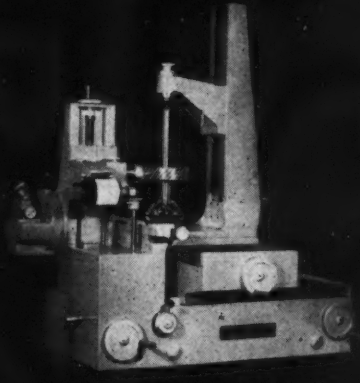

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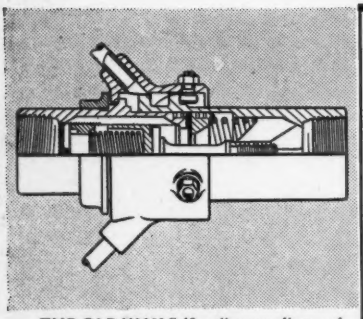
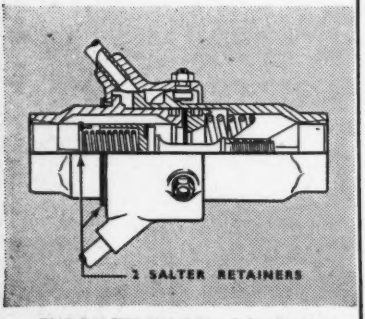
OA/6409A

How costs are cut with **SALTER** RETAINERS

Salter retainers simplify design of self-sealing coupling with great savings



THE OLD WAY Self-sealing coupling used over-sized internal and external threaded retainers . . . costly milling, turning and threading operations were necessary, and assembly slow and difficult.



THE SALTER WAY Two Salter Retainers replace heavy threaded retainers, and eliminate many costly tooling operations. Assembly, disassembly and maintenance is simplified.

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outer shoulder ring (15 mins)	4/-	*
inner retainer (20 mins)	5/4¼	
threading (4 mins)	1/0½	**14/4**
ASSEMBLY	6¼	**saved on**
total labour saving	10/11	**each unit**
MATERIAL		**by use of**
brass threaded retainers	3/5	**2 SALTER**
TOTAL SAVING WITH SALTER RETAINERS	14/4	**RETAINERS**

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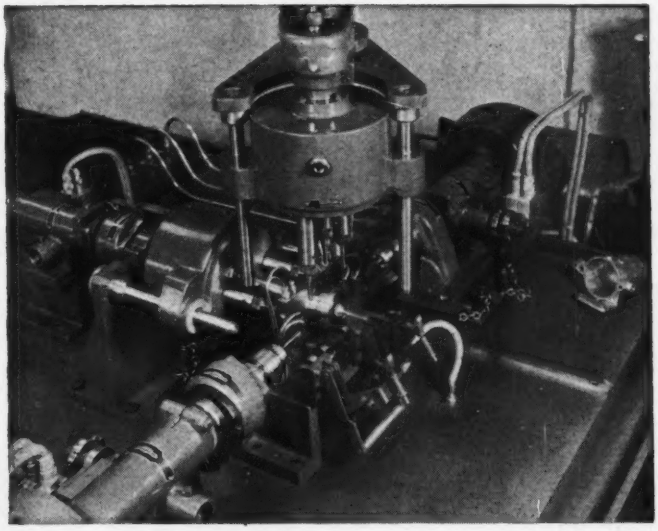
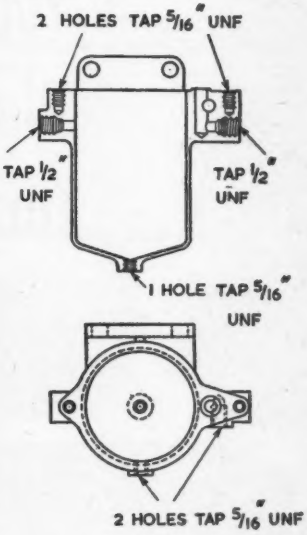
MEDDINGS Facera

TECHNICAL NEWSHEET

ITEM	Filter body
OPERATION	Tap all seven holes





The component illustrated at the right is an aluminium alloy Fuel Oil Filter Body. We designed and manufactured two machines for the drilling and tapping of this component. The drilling, countersinking and facing of the two opposed ½" UNF holes is carried out on a machine with two opposed Unit Heads. The 8-spindle tapping machine now described is for tapping the five $\frac{5}{16}$" UNF cored holes and the two ½" UNF holes previously drilled. It should be noted that the vertical head is fitted with a 3-spindle attachment in order that both left-hand and right-hand components can be tapped by loading in two alternative opposed positions. In this manner no time is wasted in setting up for either component. In operation a previously drilled component is manually loaded into the fixture and clamped. On depression of the Start Button all spindles advance and tap 7 holes, after which the component is manually unloaded. The workholding fixture is simple and efficient in operation and comprises a central spring-loaded spigot, the component being held in position by a toggle clamp. The machine is largely constructed of standard equipment and comprises 4 pitch-controlled Tapping Heads, two of which are fitted with geared type fixed centre multi-spindle Tapping Heads.
We design and build special-purpose rotary or in-line transfer machines for drilling and tapping.

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INDEXING COLLET CHUCK 17762

For multiple gang-milling, slot grinding, etc. Can be mounted on lathe and used as collet turning fixture. Fits standard collets up to 1in. bore. 2, 3, 4 and 6 index stations. Fitted with dead length stop. Indexes and locks with same lever. All working parts hardened and ground.

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Used as a standard indexing base in the machine shop. Very low working heights. Very heavy duty. All working parts hardened and ground. Can be indexed and locked with same lever. Fitted with 2, 3, 4, 6 and 8 positions. Special indexes can be arranged to suit.

HORIZONTAL DIVIDING HEAD WITH TAIL STOCK 17765

Will perform practically all indexing operations on splines, all forms of shafts, keyway operations, fluting and serrations. Exceptionally robust and strong. Very suitable for continuous spline milling or grinding where accuracy is important. Fitted with 2, 3, 4, 6 and 8 positions. Indexes and locks with same lever, working parts hardened and ground.

INDEXING TABLE 17763

For jig boring, end-milling, surface grinding, radial drilling. Designed to take sub fixtures and be used as standard indexing base. Indexes and locks with same lever. Table and all working parts specially hardened and ground. 2, 3, 4 and 6 index stations.

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Can be used as a Dividing Head or Collet Fixture in the Vertical or Horizontal Plane. Supplied with two sets of Index and masking plates with Irregular or regular positions within 20 or 24 Indexes. All working parts hardened and ground.

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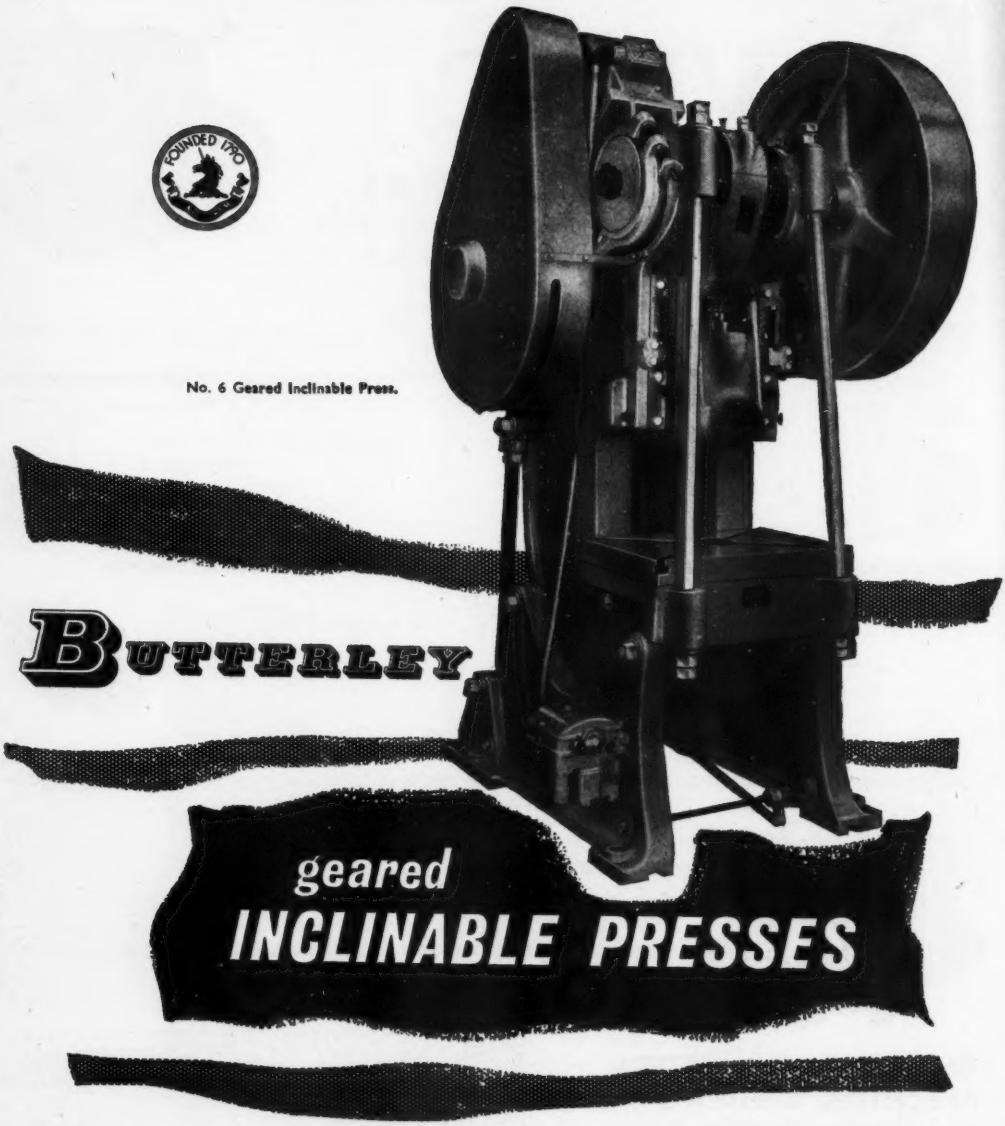

No. 6 Geared Inclinable Press.

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The word MEEHANITE is a registered trade mark.

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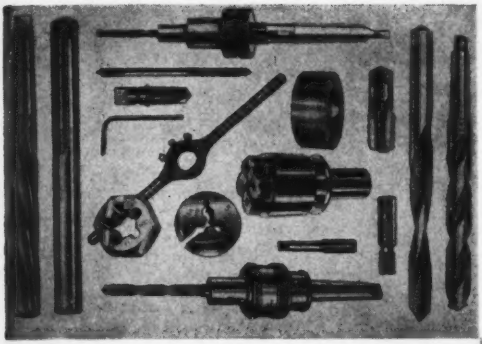
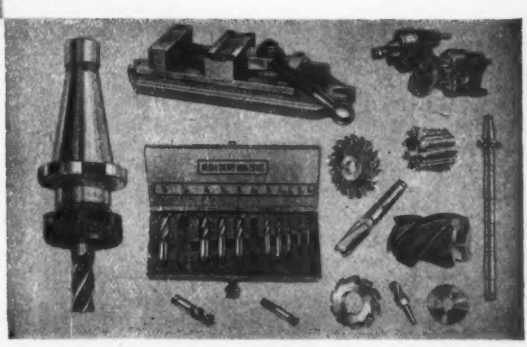


supreme

B·S·A



Milling cutters, twist drills, reamers, taps and dies, dieheads, tapping attachments, screwed shank tools and chucks, thread rolling dies, drill chucks, drill holders and adaptors, arbors, oil and suds pumps, machine vices, lathe chucks, magnetic chucks and equipment, hacksaw blades, broaches, limit switches.

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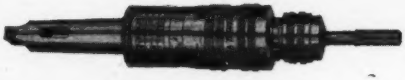

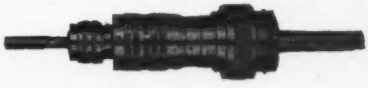

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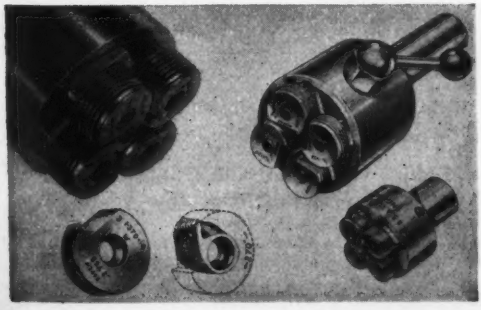
B.S.A. NAMCO dieheads are simple in construction and easy to adjust. Circular chasers ensure extreme accuracy of thread form and long life; they can be reground through 270° of their circumference. The range includes types for stationary or revolving spindles and for Swiss type and turret automatics.



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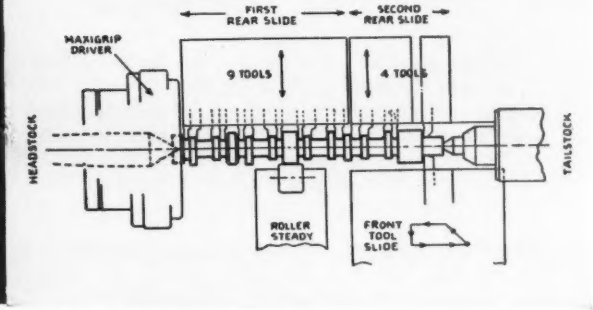

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Voltages: 100/110, 200/220, 230/250.
50 cycles or 60 cycles.

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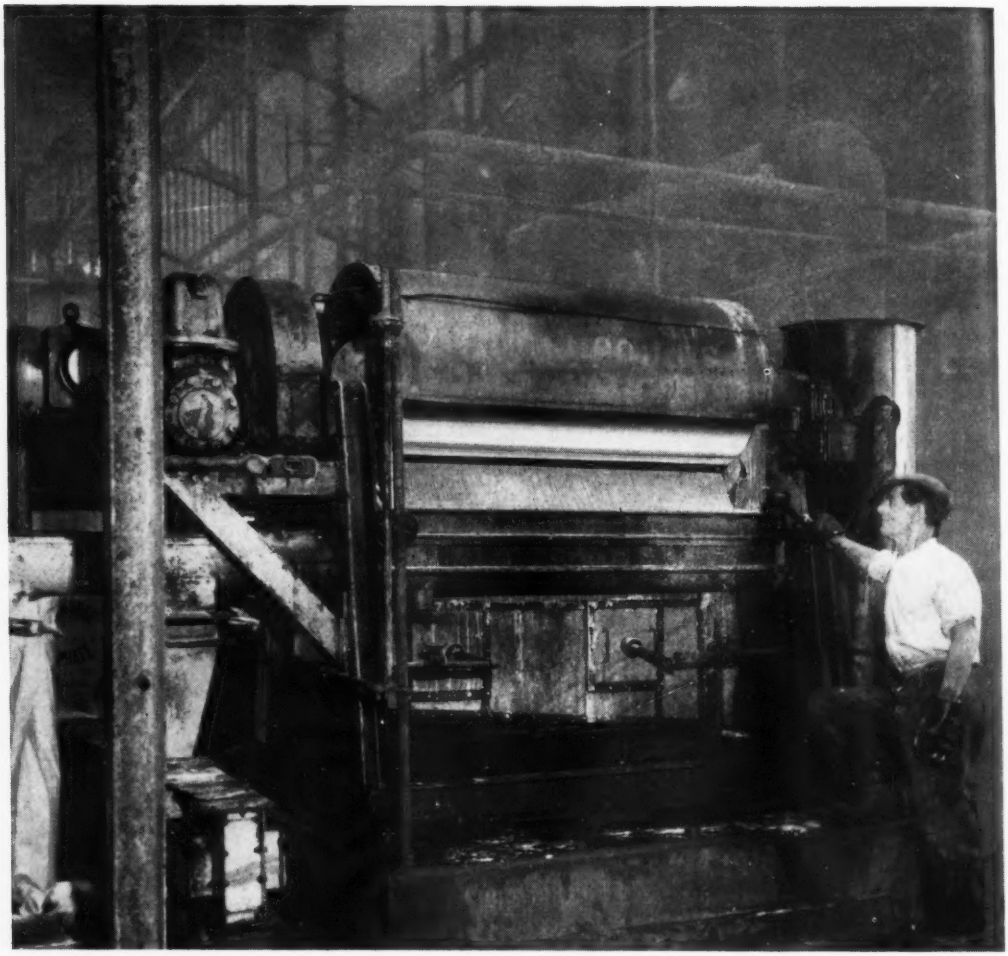

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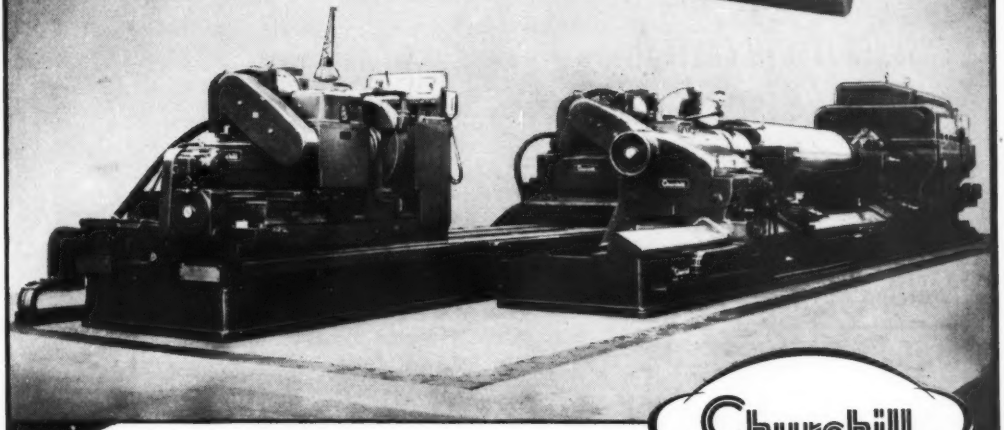

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ANNOUNCE

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CLEVELAND 11, OHIO, U.S.A.

covering their Single-Spindle 7 H D HIGH Production Hobbing Machines

Established over 50 years ago, The LEES-BRADNER COMPANY are acknowledged specialists in the development and manufacture of Manual and Fully-Automatic Single and Multi Spindle Hobbing Machines for Individual and "In-line" applications.

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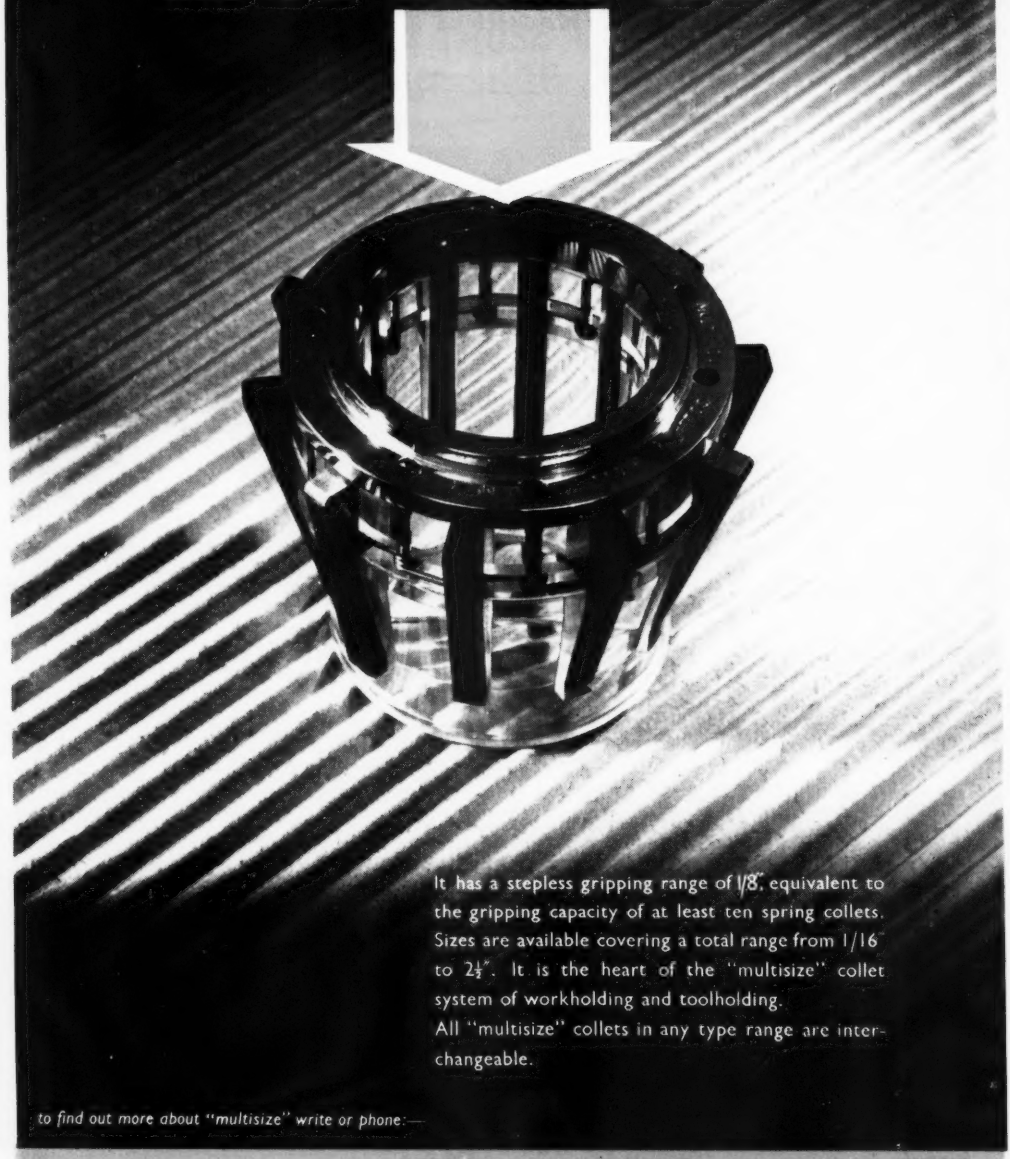

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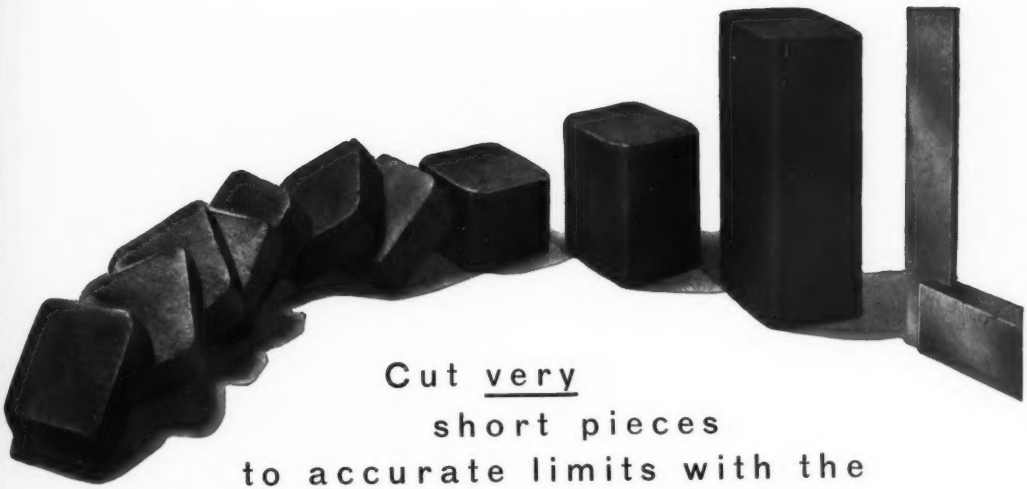

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AUTOMATIC HYDRAULIC DUPLICATING DIE-MILLER

COMBINED WITH A

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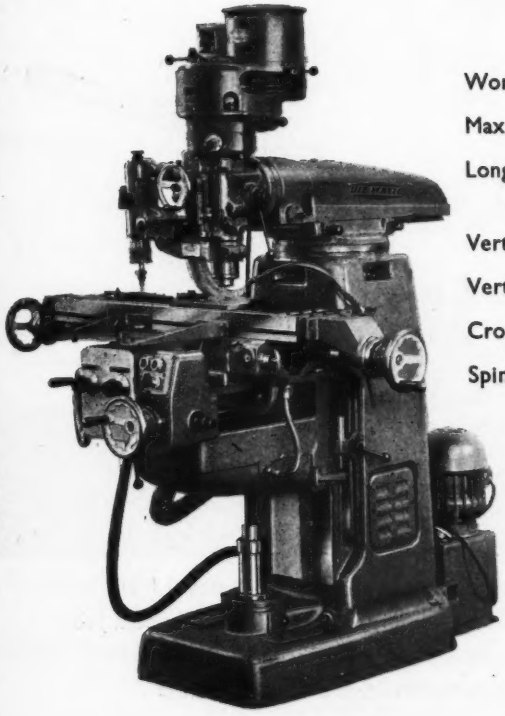

SPECIFICATION

Working surface	43" × 10"
Max. dist. spindle to table	14½"
Longitudinal table traverse ..... (hydraulic—manual)	14" + 14"
Vertical (knee) (hydr.—manual) ..	4" + 13"
Vertical (quill) (mechanical)	5"
Cross (saddle) (hydr.—manual)....	10" + 10"
Spindle speeds range, r.p.m.....	80 to 2715

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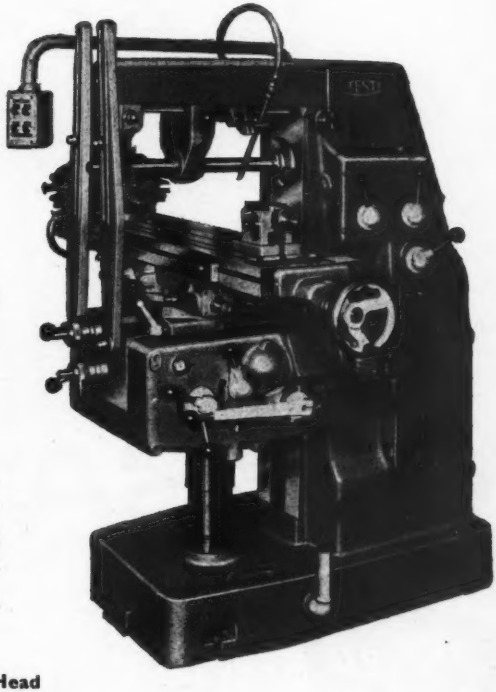

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- ★ **Hardened and ground gears**
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- ★ **Electro Magnetic Clutch**
- ★ **Backlash Eliminator**

BRIEF SPECIFICATION

Table:	Working surface	.. 48in. by 11in.
Table Feeds:	Longitudinal	.. 29in.
	cross (without brace)	.. 9in.
	vertical	.. 17¾in.
Spindle:	Spindle Nose	No. 40 N.S.
	18 speeds	40 to 2000 R.P.M.

STANDARD EQUIPMENT—COS-PAR Dividing Head Vertical Milling Attachment Arbor, Front Braces Coolant Equipment etc.

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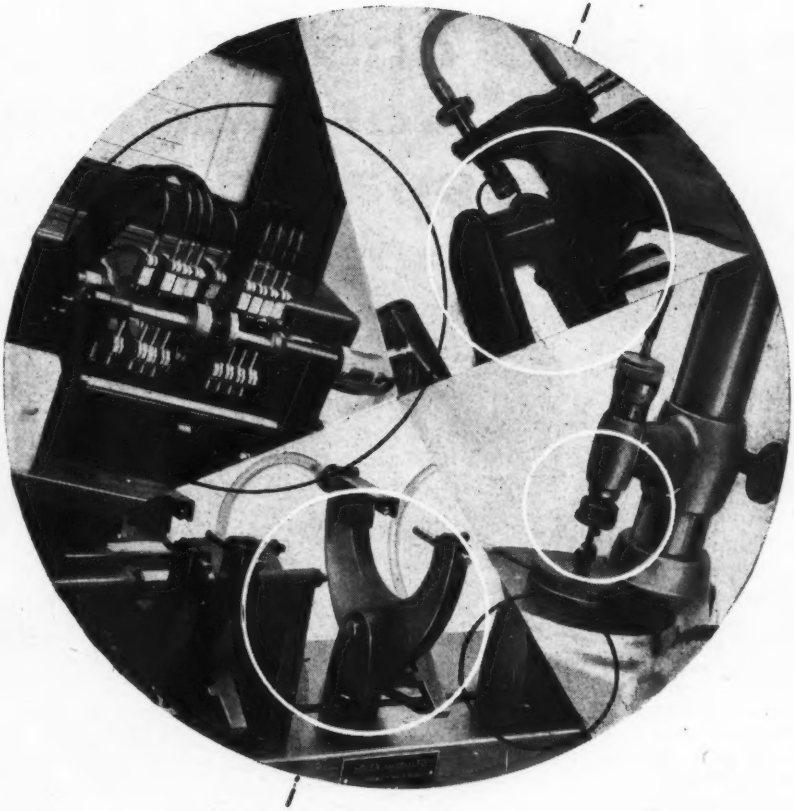

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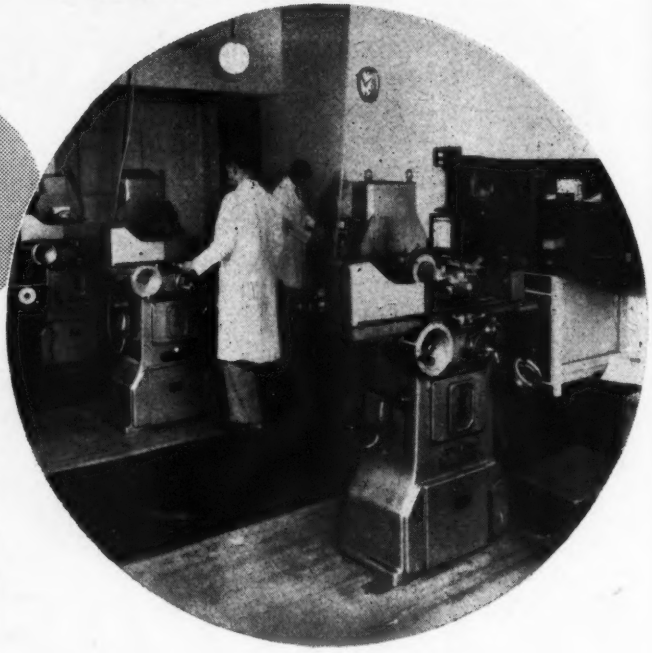
J&S chosen for diamond research



At the beginning of 1958 Diamond Research Laboratory, Johannesburg, South Africa started a methodical investigation into the use of diamond particles in grinding wheels. As the programme expanded Jones-Shipman Model 540 Surface Grinders were selected to carry out comprehensive tests. Four of these machines have been installed in the laboratory by our South African Agents, Messrs. Rogers-Jenkins & Co. (Pty) Ltd. The tests are still continuing and to date some 600 different diamond wheels have been tested and more than 2½ tons of tungsten carbide has been ground away. Several other models of Jones-Shipman Precision Grinding Machines including Models 1300 and 1310 semi-universal grinders are used in the Laboratory tool room which produces most of the special purpose experimental equipment for use in the organisation.

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Suitable for work on bar, castings, forgings and stampings

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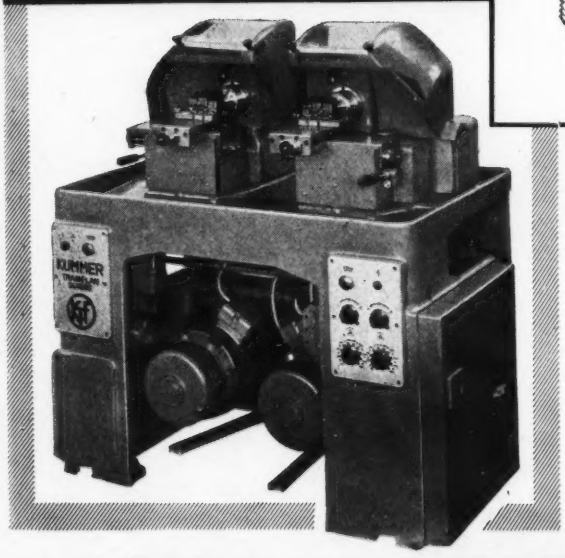

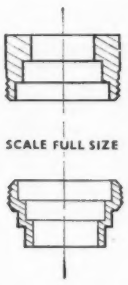

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Material—BRASS (Billet)

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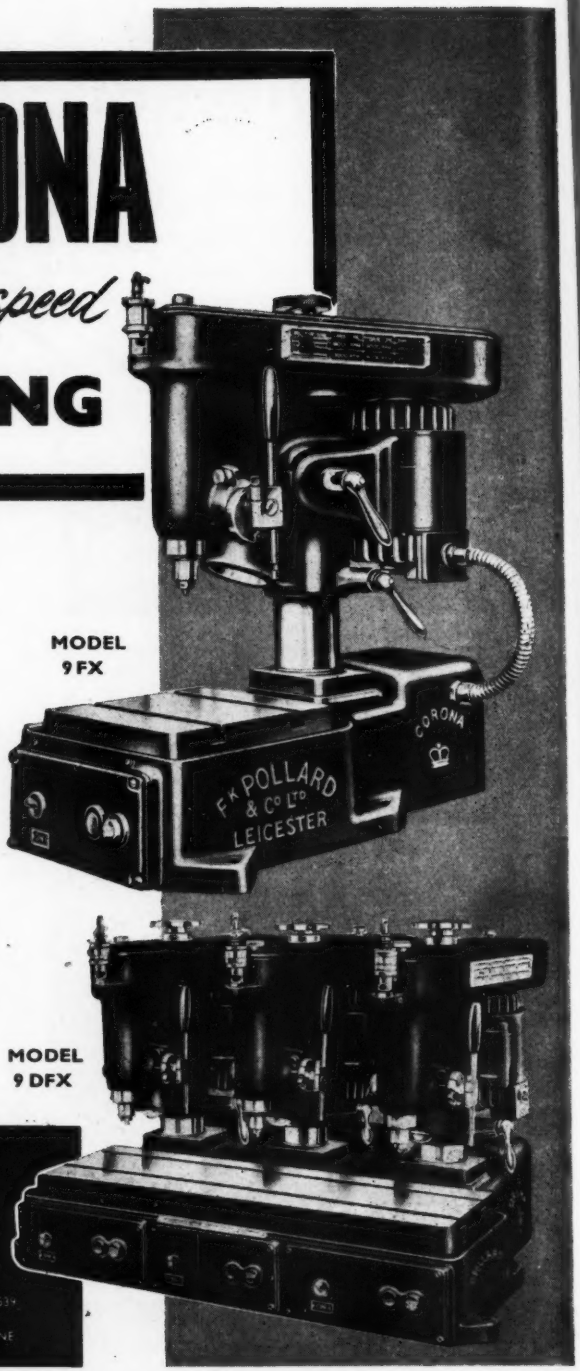

MODEL 9 FX

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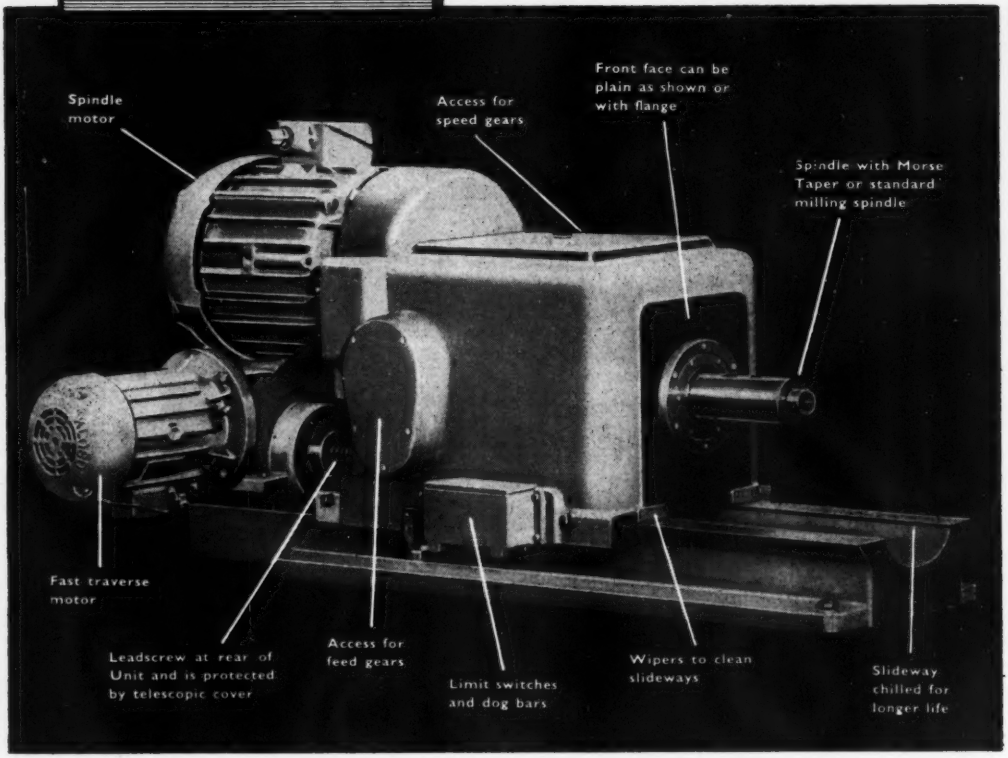
AMT ELECTRO MECHANICAL SCREW FEED UNIT HEADS


Spindle motor
Access for speed gears
Front face can be plain as shown or with flange
Spindle with Morse Taper or standard milling spindle
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Leadscrew at rear of Unit and is protected by telescopic cover
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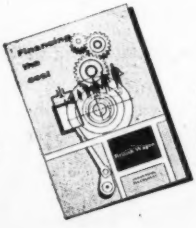

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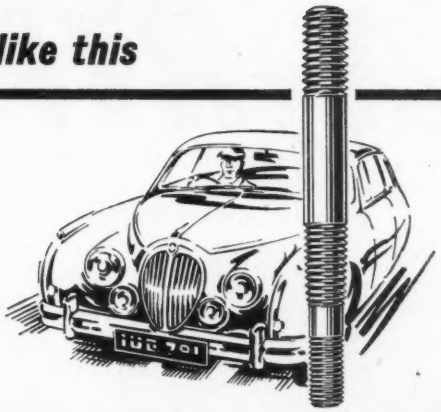
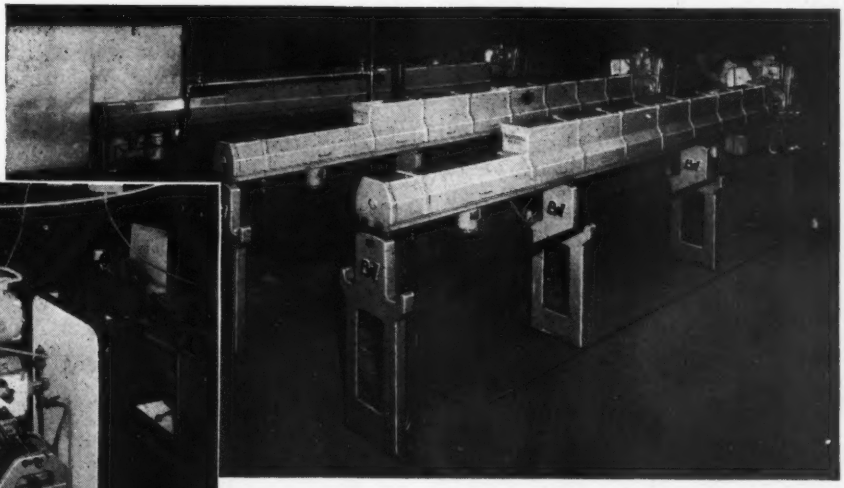
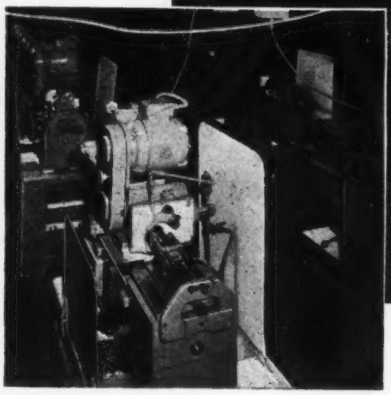


JAGUAR cars choose BROWN & WARD





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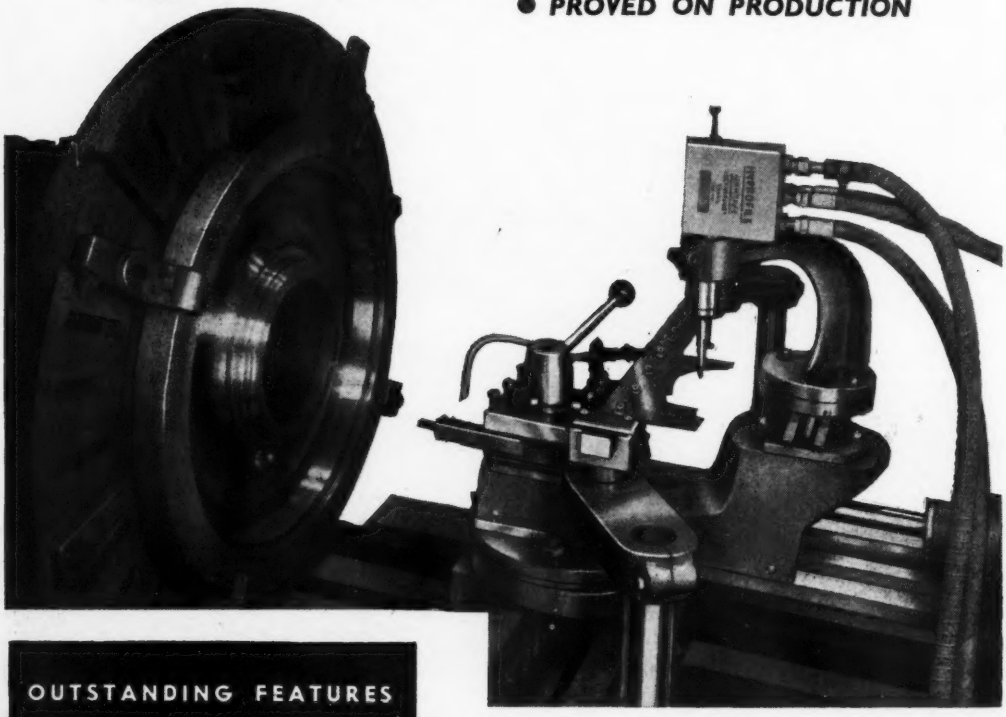

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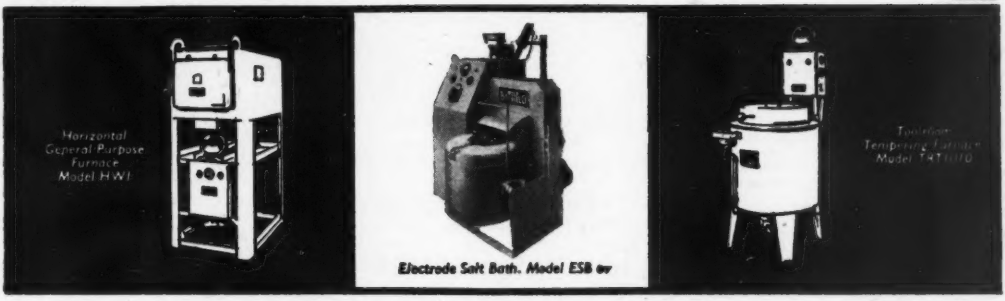
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There are standard **Wild-Barfield Furnaces** for all heat treatment purposes

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WB91

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GROUND THREAD TAPS and GAUGES

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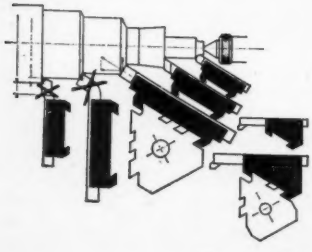
'TRIPAN' TOOLHOLDERS

ensure consistent accuracy & high output

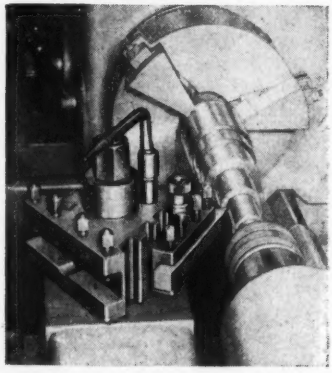
Centre lathe output practically that of a capstan

- Setting-up time reduced. Height of tool quickly adjusted by self-locking screw.
- Large or small toolholders can be used on the same clamping block. The most economical toolbit size can be chosen, e.g., large cutters for roughing and small ones for finishing.
- The clamping block does not rotate and therefore positioning errors due to worn parts are eliminated. The toolholders are locked on three faces ensuring constant accuracy of positioning.
- Any number of toolholders can be used in rotation, including parting off, boring bar and twist drill holders.
- The triangular shape ensures: improved visibility, reduced tool overhang, tool presented to the work from the most effective angle.



TRIPAN DESIGN ENSURES RIGID ASSEMBLY—VITAL FOR CARBIDE CUTTERS

This diagram shows—on the right—the correct TRIPAN cutting positions. Note the reduced tool overhang and how the full cutting power is utilised. Avoid cranked tools and the cutting positions shown on the left—these are inefficient.



The TRIPAN (patented) system comprises a triangular clamping block and a range of interchangeable toolholders. The clamping block is selected according to the centre height of the lathe and the toolholders according to the size of the cutter and the work to be done.

Sole Concessionaires

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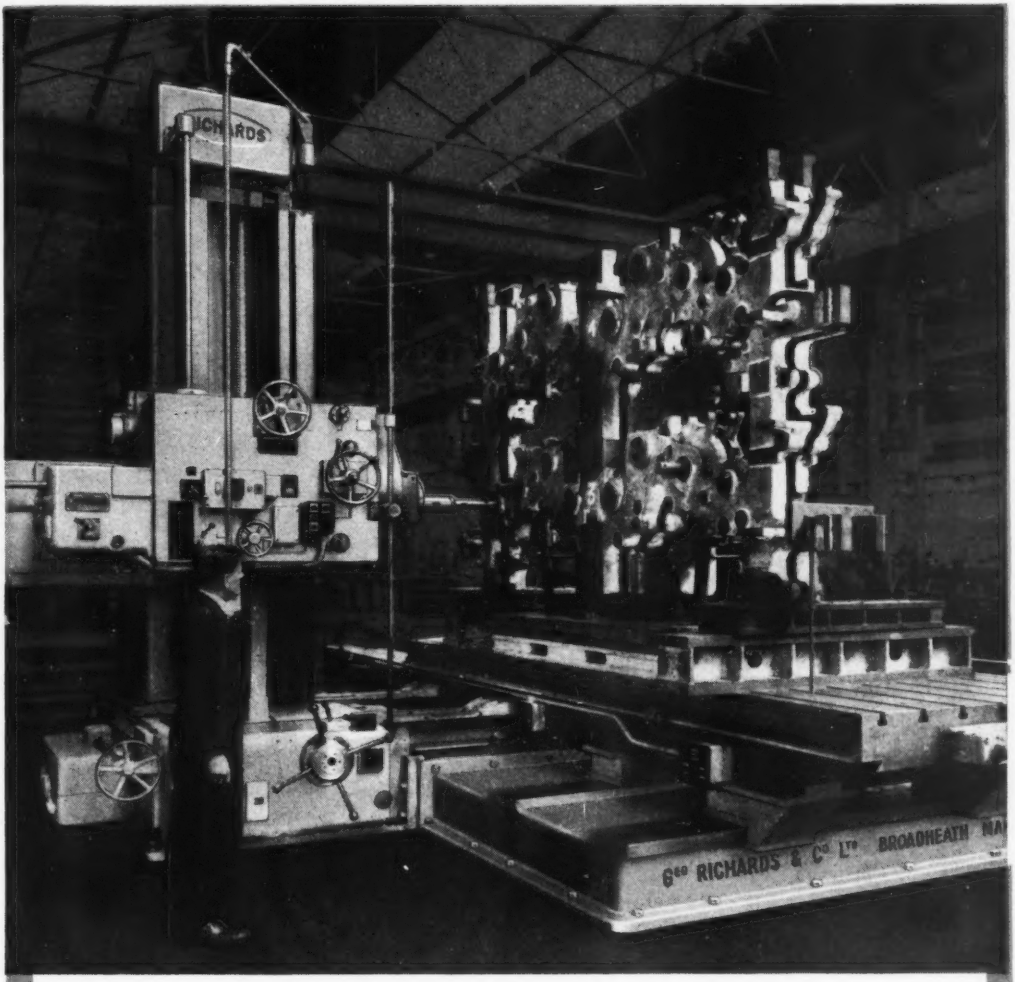

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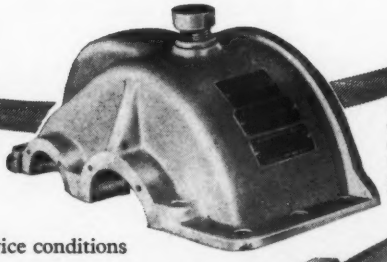

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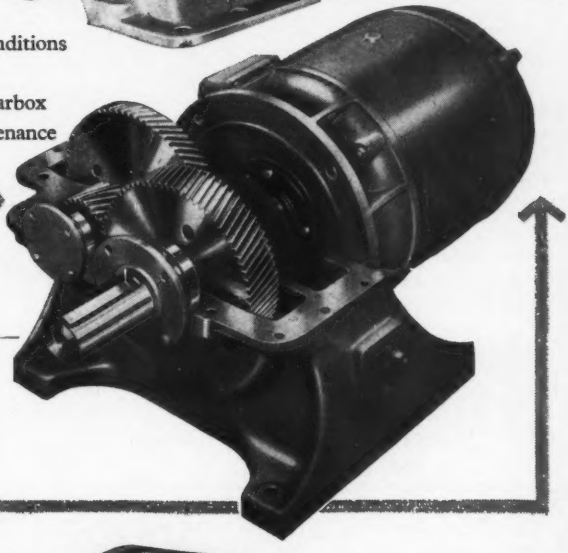

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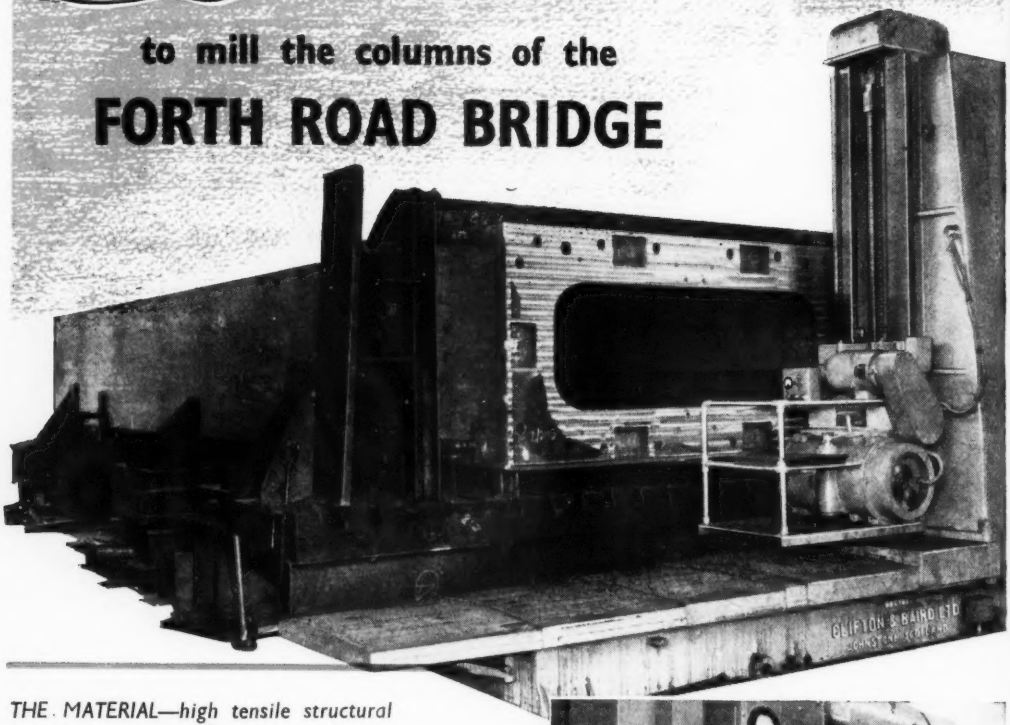

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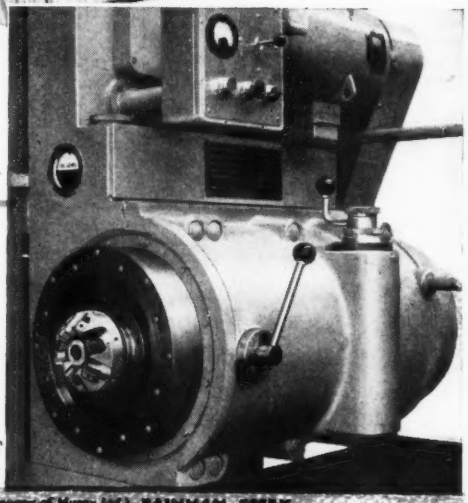

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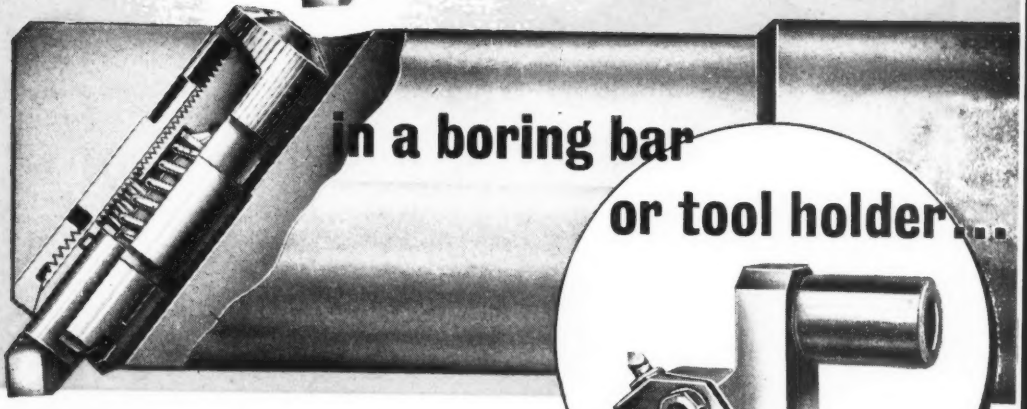

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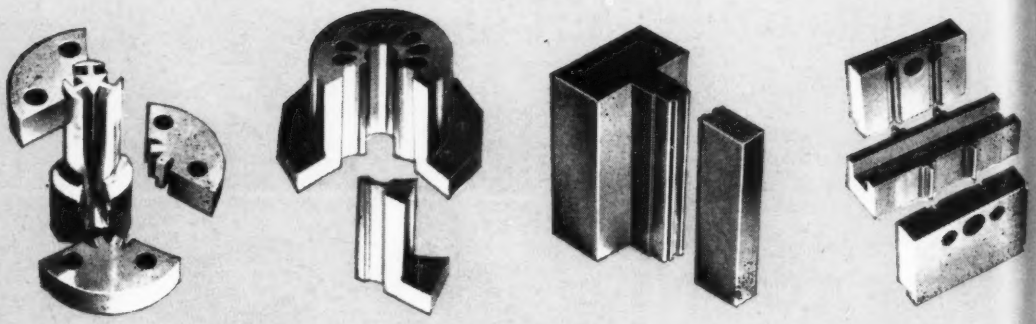

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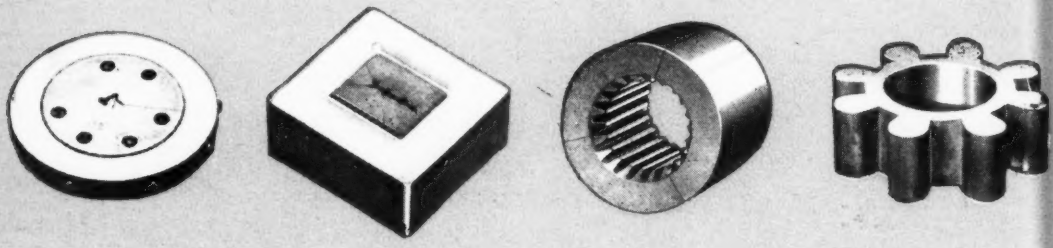

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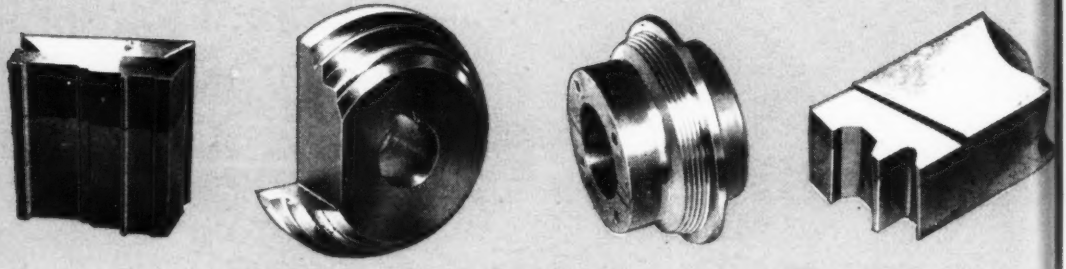

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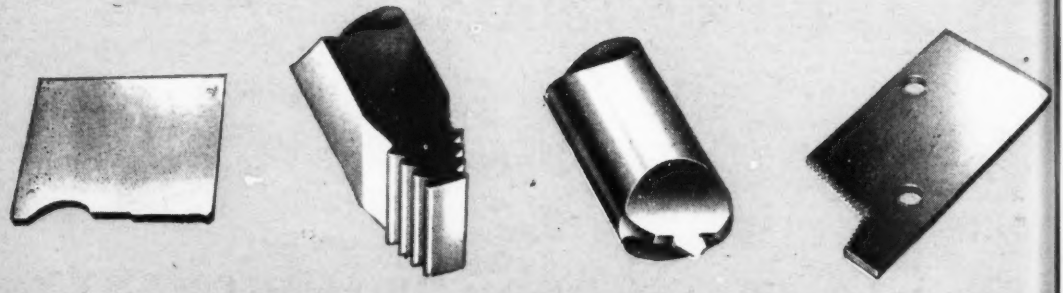

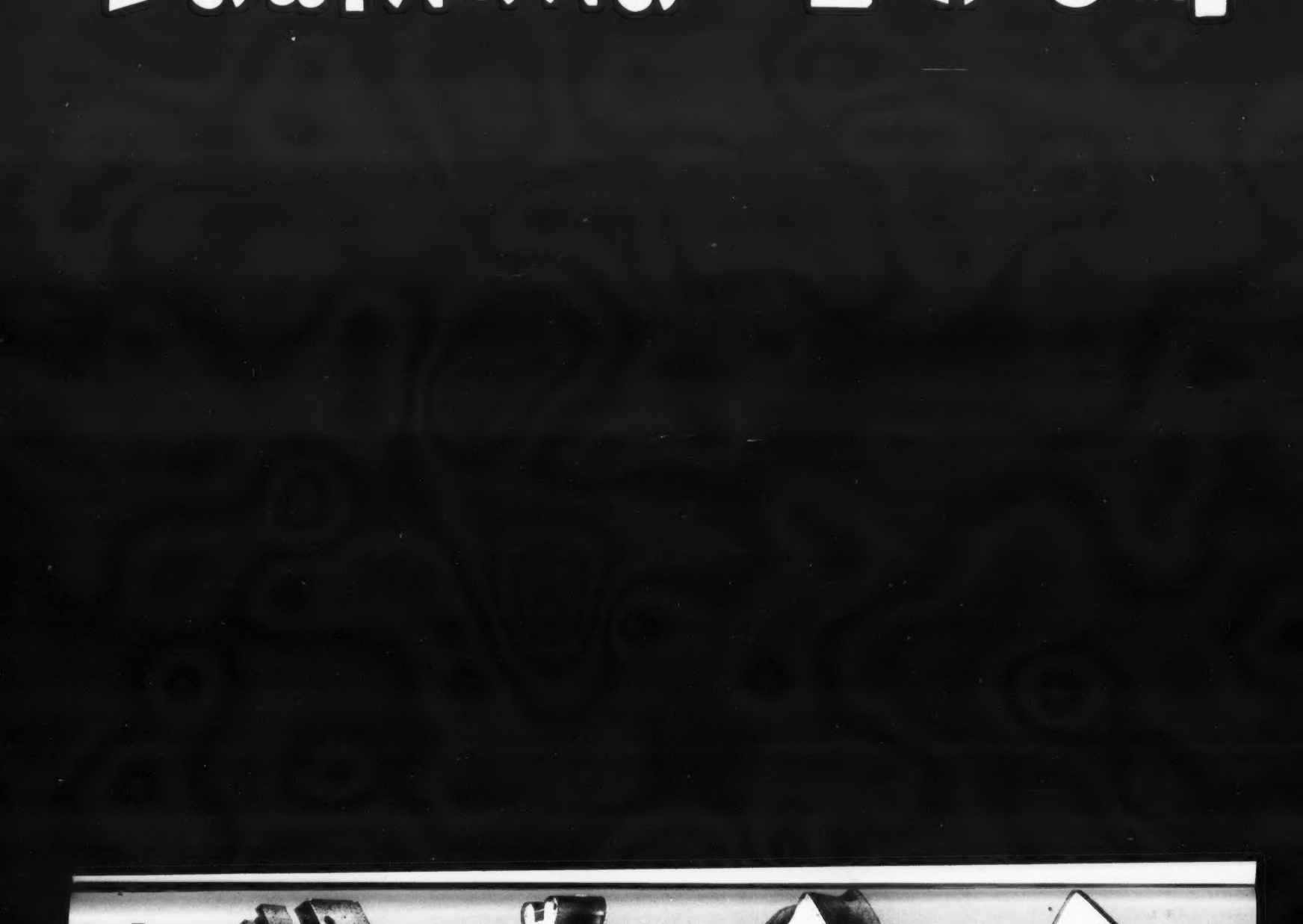

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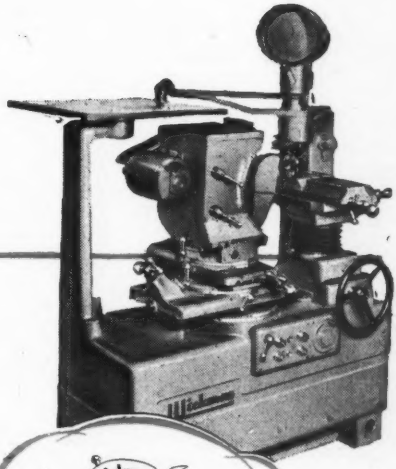

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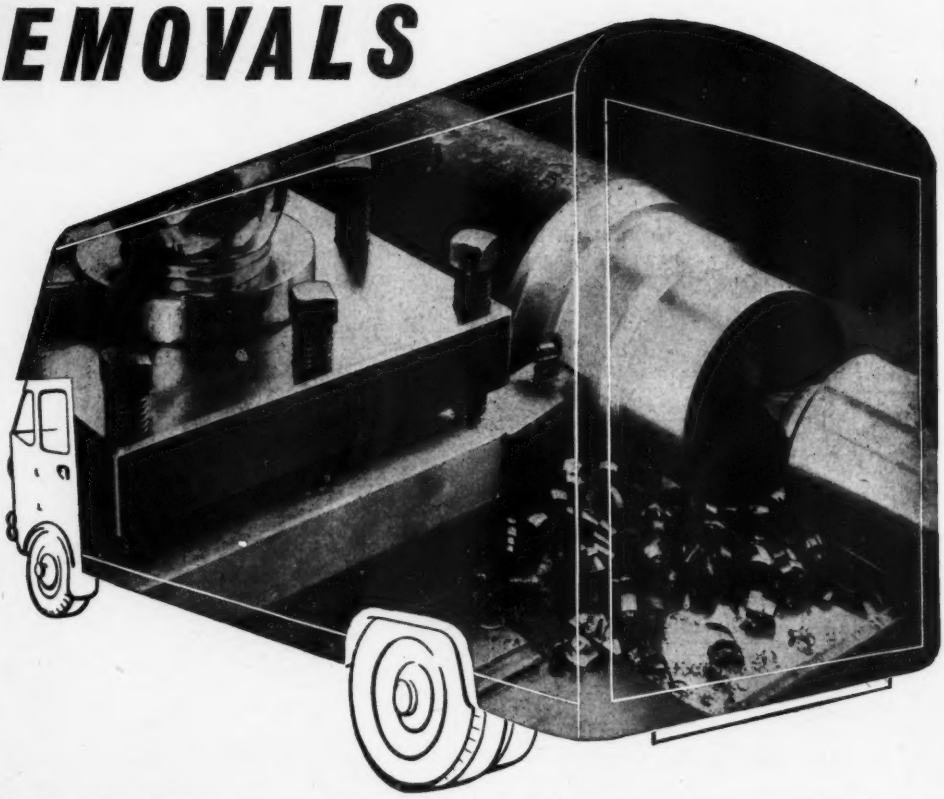

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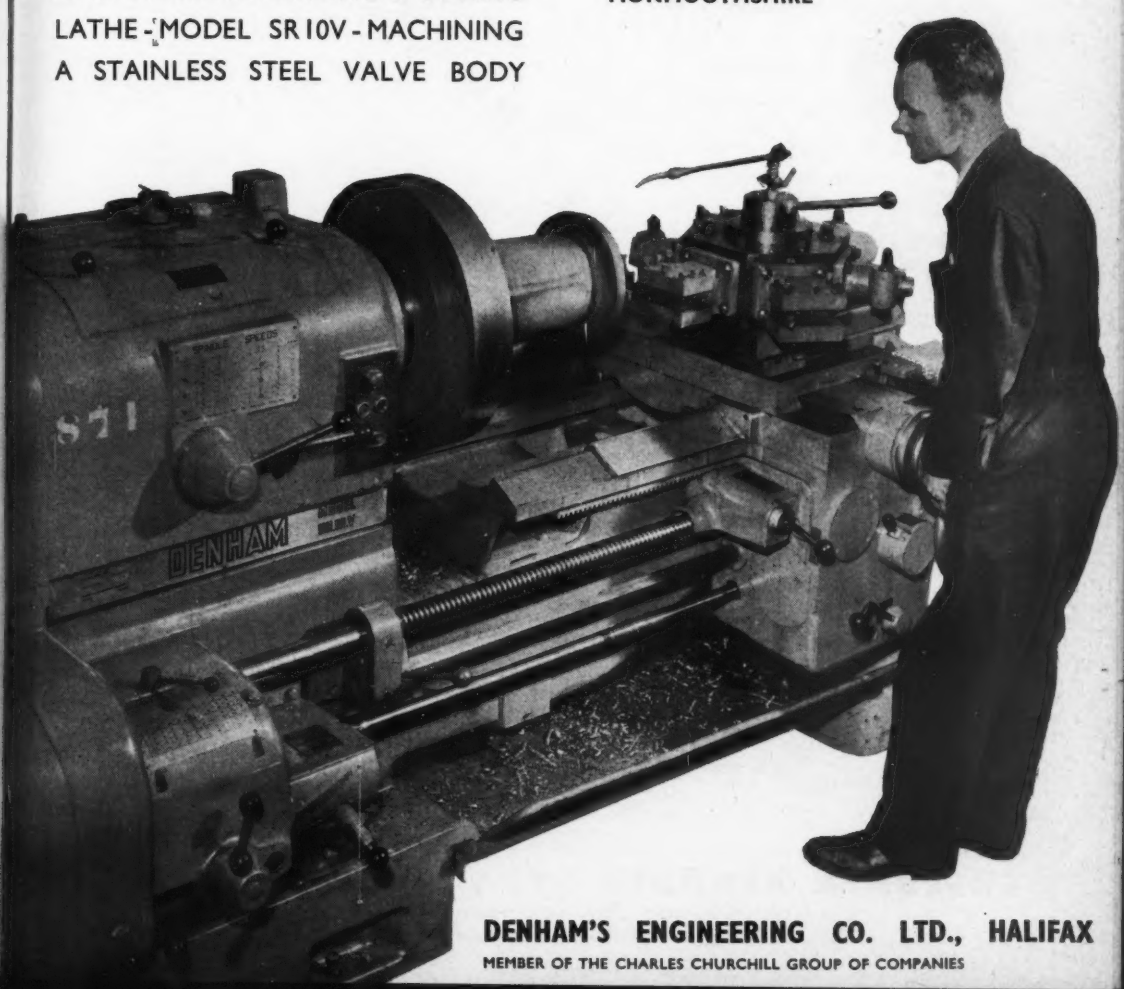

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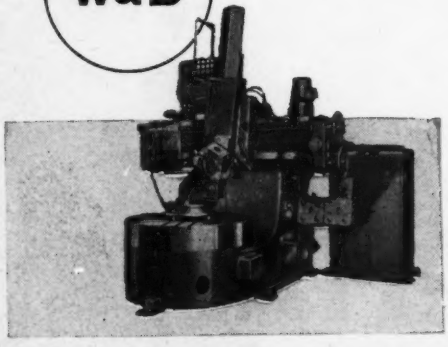

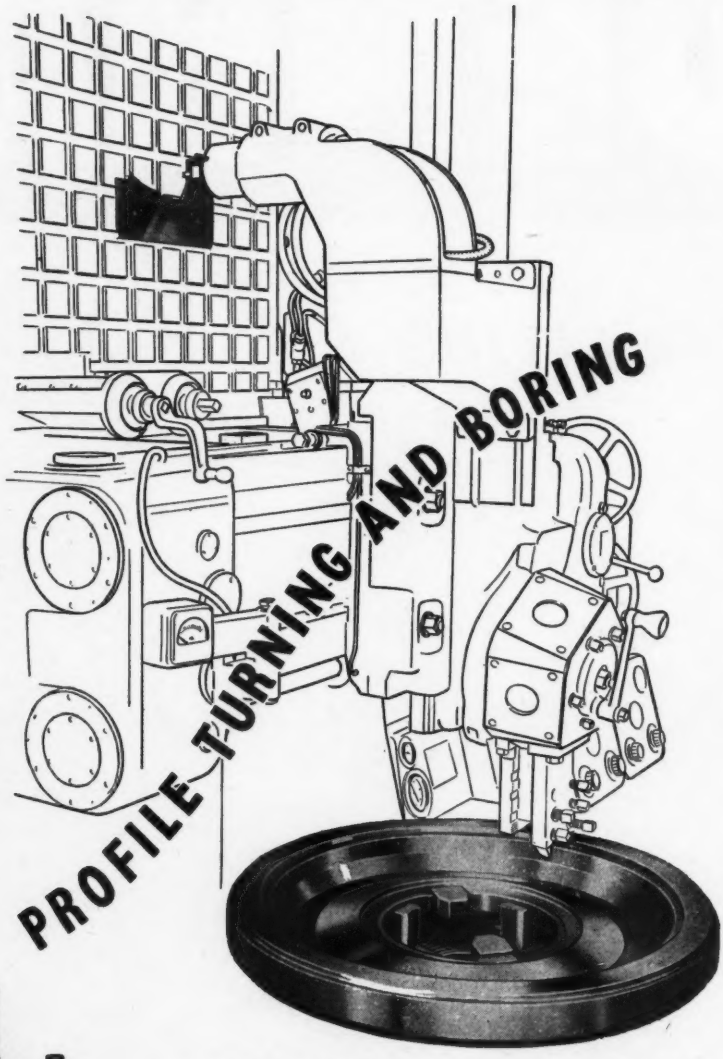

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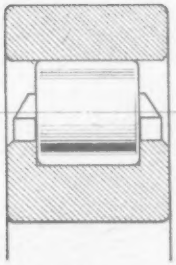

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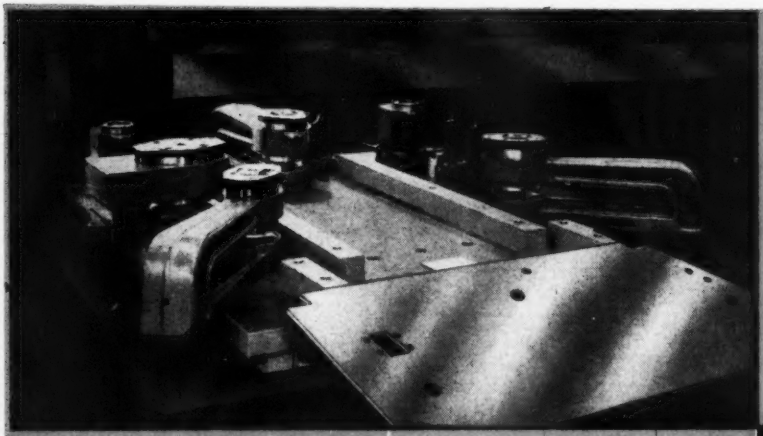

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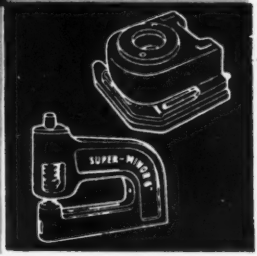

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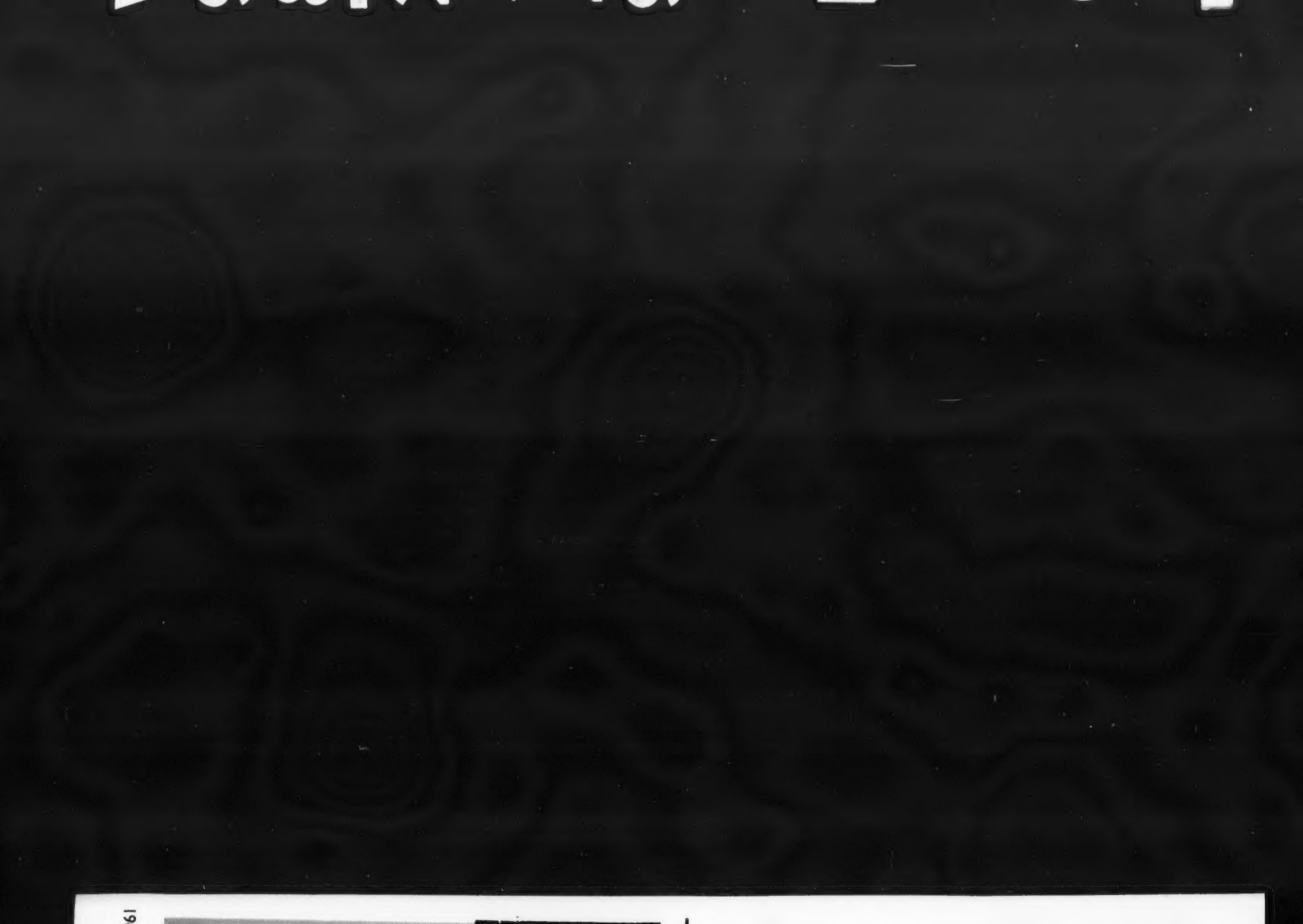

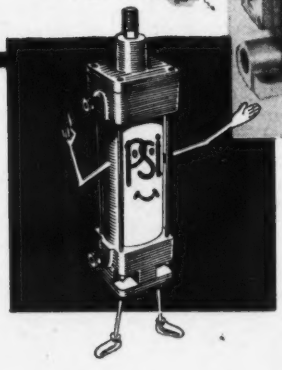

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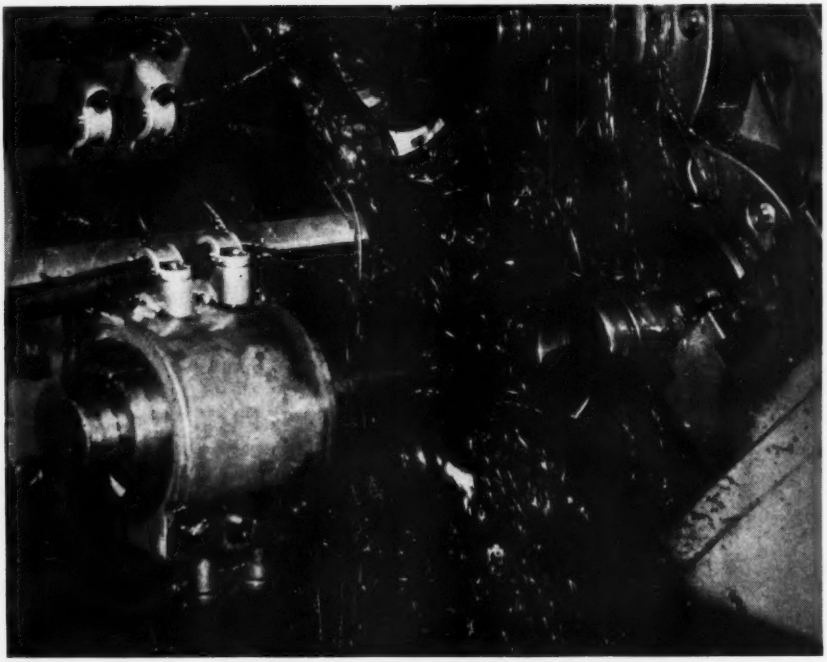

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MACHINERY

A JOURNAL OF METAL-WORKING PRACTICE & MACHINE TOOLS

Vol. 98, No. 2529 May 3, 1961

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Making Components for Type Casting and Composing Machines .. .. P. 988

The Monotype Corporation, Ltd., Salfords, Surrey, build casting and composing machines for the printing trade, and the latest unit is the Monophoto filmsetter. This machine produces text on film or sensitized paper from small single-character negatives, termed film matrices. One of the most important assemblies in the machine is the matrix case, which includes the matrix holder for 255 individual negatives, and a cover plate. In each of these members there are 15 rows of 17 holes, each of square cross section. Holes in the holder are produced by broaching, with hand operated equipment that incorporates the turret slide from a capstan lathe, whereby five broaches are indexed to the operating position in turn. The holes are drilled in preparation for broaching, with a multi-spindle set-up and an indexing fixture, and slots, of vee and rectangular section, are milled after broaching has been completed. Machines for the milling operations have been specially adapted by the company. Cover plates are pierced in two stages, and for the first, an air- and cam-operated indexing tool is used. (MACHINERY, 98—3/5/61.)

Typical Machining Operations on Aluminium Cylinder Heads .. .. P. 1000

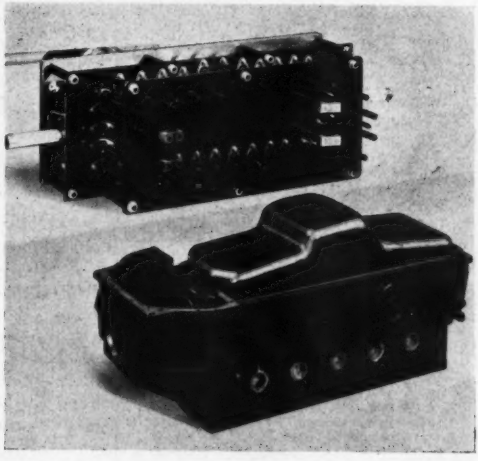
Cylinder heads for Oldsmobile F-85 cars are made from aluminium gravity die castings, and are machined on a line which has special provisions for swarf disposal and the supply of coolant. The five main surfaces of the block are milled on a 7-station Snyder transfer machine, which is followed by a 13-station Footburt machine for milling and drilling. There is a second Footburt machine with 17 stations, and on leaving this machine the cylinder heads pass through washing and leak-testing stages. Faulty heads are passed to an automatic impregnating machine. Cast iron valve-seat inserts and valve guides are pressed into the heads on a 7-station Parker transfer machine, and are subsequently finished on a W. F. & John Barnes machine. Final machining is performed on a Snyder unit, which is followed by a further cleaning stage. (MACHINERY, 98—3/5/61.)

East German Machine Tools at the Leipzig Fair .. .. P. 1006

This second article on machine tools exhibited at the Leipzig Spring Fair describes some standard and special grinders. An optical machine, for profile grinding form tools and other parts, is equipped with a wheel-head having compound adjustments and a projection screen covering a field of 0·315 in. at an enlargement of 25×. Drum-type face-grinding machines for semi- and fully-automatic grinding of motor vehicle universal joint spiders and tappets, respectively, were shown. Rough- and finish-grinding of tappets was performed automatically with an ingenious arrangement for unloading, indexing and reloading the components. Centreless grinding of the stems of these valve lifters was also demonstrated on a machine fitted with automatic loading, unloading, gauging, and correction equipment. Another, smaller centreless grinder was equipped for finish through-feed grinding of tapered bearing rollers. (MACHINERY, 98—3/5/61.)

❖ ❖ ❖

The multiple tool here shown has been supplied by Desoutter Bros., Ltd., The Hyde, Hendon, London, N.W.9, to Vauxhall Motors, Ltd., Luton, for tightening, simultaneously, the 31 screws which secure the sump for a 6-cylinder engine. Desoutter SA50/375 pneumatic motors drive the tools, and four magnets serve to hold the sump in position as it is lowered over the engine



Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

The Growing Importance of Ultrasonics

For the purpose of improving efficiency in connection with the many different aspects of production, it is important that the potential applications of the newer techniques should be thoroughly investigated with a view to their adoption wherever they offer the possibilities of reducing costs or improving product quality. Since the second world war, much research and development work has been carried out in connection with the utilization of high frequency vibrations for a variety of purposes, and their value in several distinct fields has been fully established.

Among the most important applications of ultrasonic vibration is the agitation of fluids, principally for cleaning purposes. For an increasing number of precision components and assemblies, very high standards of cleanliness are necessary to ensure reliable operation in service, and the searching action that results from the cavitation effects associated with high frequency vibration enables the required results to be achieved conveniently and economically. In addition, ultrasonic cleaning has proved very effective for removing adhering contaminants from workpieces where good appearance is a primary consideration. Such deposits frequently remain after polishing operations have been carried out, and substantial savings have been obtained, for example, in connection with the finishing of spectacle frames and components for lighters. Advantage is also taken of the cavitation resulting from vibration in fluid for more specialized applications, and reference may be made to the soldering of metals such as aluminium on which oxide films must be broken down, and to certain pickling operations. For the latter purpose, vibration is transmitted from an outer tank containing water to an inner tank, in which the work is immersed in acid solution. In this way, it is stated, the action is greatly accelerated, and the need for prolonged soaking is avoided.

Ultrasonic equipment is also being employed on an increasing scale for the detection of internal flaws in welded joints, also in forgings, castings, and rolled metal products. The principle of this application is now well known, but it may be noted that as a result of progressive developments in the technique the field has been greatly extended as regards the range of workpieces and material forms that can be inspected and the sensitivity with which defects can be detected. Higher standards of work quality for exacting applications can thus be ensured. As an indication of the results that are now being achieved, it has been reported, for instance, that sheet steel is automatically inspected as it is unwound from coil at high speed and defective areas are marked for subsequent identification.

Closely allied with the technique of flaw detection is the measurement of thickness of metals and other materials where only one side is readily accessible. This method is being used with good results both in production and for such purposes as checking the extent of corrosion that has occurred in service. At the works of one company, an ultrasonic resonance gauge is being employed for checking the thickness of large plastics nose cones and radomes. On a large cone, it is stated, as many as 4,000 thickness measurements may be necessary, and for this particular purpose, the method offers the special advantage that checks can be made when the component is still in position on the forming mandrel.

For machining operations, especially on hard and brittle materials which may be either metallic or non-metallic, ultrasonic methods are also assuming growing importance. Holes or cavities of non-circular cross section may, for instance, be produced in such materials as tungsten carbide. For such purposes, vibration alone is normally employed, but a method has also been developed whereby ultrasonic action is combined with spark machining, and it is claimed that considerable advantages are thus offered in certain circumstances. Other applications include the slicing and dicing of silicon, germanium, and sapphire, the production of internal screw threads in very hard materials, the "blanking" of shaped parts from sheet, and the drilling of small diameter holes.

Ultrasonic welding is another process which is commanding increasing attention as a means of solving some of the innumerable jointing problems with which the production engineer is confronted. This method has been found to offer considerable advantages for certain purposes, and here again, as a result of developments in the equipment available there has been a rapid extension of the range of work that can be handled.

Recently, another application of ultrasonics has been reported which appears to offer impor-

(*Continued on page* 1036)

Making Components for Type Casting and Composing Machines

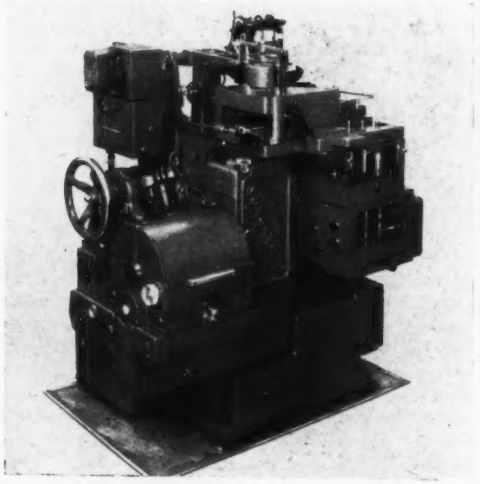
Methods and Equipment Employed by the Monotype Corporation, Ltd., Salfords, Redhill, Surrey

By P. A. SIDDERS, Chief Associate Editor

MACHINES EMPLOYED IN THE PRINTING INDUSTRY must operate at high rates of output and to very precise limits of accuracy if printed matter that is easy to read and of pleasing appearance is to be produced economically. Accuracy is of particular importance in connection with machines used for the reproduction of high-quality magazines and periodicals, and among the best known machines for this purpose are those built by the Monotype Corporation, Ltd., Salfords, Redhill, Surrey. The range of Monotype equipment includes Composition Casters, Type and Rule machines, and Super Casters, also the associated keyboard units, for the production of pieces of type, each bearing one character, which are assembled into rows, each corresponding to one line of text.

The operation of a Monotype composition caster was described in an earlier series of articles* in MACHINERY, but it will be appropriate here to consider, very briefly, the functioning of the unit. Information is fed into the Composition Caster by means of a perforated paper ribbon, which is produced on the keyboard, and provisions are incorporated for "justifying" each line, after the characters comprising it have been "tapped out", so that the rows of type produced by the Composition Caster are of equal length, with uniform spacing between the words in each line.

Each piece of type is produced by the combined action of a mould and a matrix. Type is cast vertically, with the character uppermost, the latter being formed by the impression in the matrix, and the body by the aperture in the mould. It will be appreciated that bodies of different cross-sections are required for the various characters—for example, a wider-section body is needed for a letter "m" than for a letter "i". The mould is a complex unit, made to very close tolerances, and incorporates sliding members that form the aperture and are automatically adjusted to suit the character on the piece of type that is being cast. Automatic adjustments must be carried out at high speed, since the output rate of a Monotype Composition Caster could be at least 180 pieces of type per minute.



The matrices that form the characters are carried in a matrix case, which has 15 columns, each with 17 matrices. In accordance with the information punched on the paper ribbon, the matrix case is moved in two directions mutually at right angles to position the appropriate matrix over the aperture of the mould. It is then clamped in position and the molten type metal is injected.

MONOPHOTO FILMSETTER

Increasing use is being made of photo-lithography and photogravure for the printing of magazines, the less-expensive books and other matter, and for this reason, the Monophoto filmsetter has been introduced. One of these units is seen in the heading illustration, and it is controlled by a perforated paper ribbon, which is identical to that used for the caster and is produced on a similar keyboard, shown in Fig. 1. Instead of casting individual pieces of metal type, however, the filmsetter produces negative or positive reproductions of the required text directly on film or sensitized paper, the actual system of reproduction depending on the printing method used.

* MACHINERY, 80/487—20/3/52, 80/619—10/4/52 and 80/795—8/5/52.

Fig. 1. The keyboard unit employed to pierce the paper ribbon that is used to control the Monotype Composition Caster and Monophoto filmsetter (seen in the heading illustration)

Although the caster and filmsetter differ as regards the method of reproduction, they are similar in many respects, and the filmsetter is provided with individual matrices for the various characters. Fig. 2 is an exploded perspective view of a filmsetter matrix case assembly, and each matrix comprises a piece of film with a transparent character on a black background, mounted in an accurately-made metal carrier of approximately $\frac{3}{16}$-in. square cross-section. A total of 255 matrix-film carriers is housed in a holder (15 columns of 17 carriers), the holder, in turn, being fitted into a case. The assembly is completed by a transparent dust cover and a perforated steel cover plate. In operation, the matrix case is positioned in accordance with the information on the perforated paper ribbon, to align the required matrix-film with the axis of the optical system of the machine.

It may be of interest briefly to consider the optical system, which is shown diagrammatically in Fig. 3. Light from a bulb, of motor car headlamp type, is passed through a condenser lens system to ensure even illumination, and is directed through the matrix-film in line with the optical axis. Below the matrix case there is a shutter which allows the light transmitted by the matrix-film to pass through a projection lens, whereby an image of the character on the matrix-film is thrown on to a sheet of film or paper carried on a drum. Two prisms are incorporated in the optical system to "fold up" the light path, and thus save space. The positions of the prisms and projection lens are adjustable to enable the image to be accurately focused, also to enable images of a limited number of point sizes to be produced from one set of matrix-films. Positioning of the prisms and lens is carried out with the aid of standard length bars.

(The size of type is denoted by a point system. There are approxi-

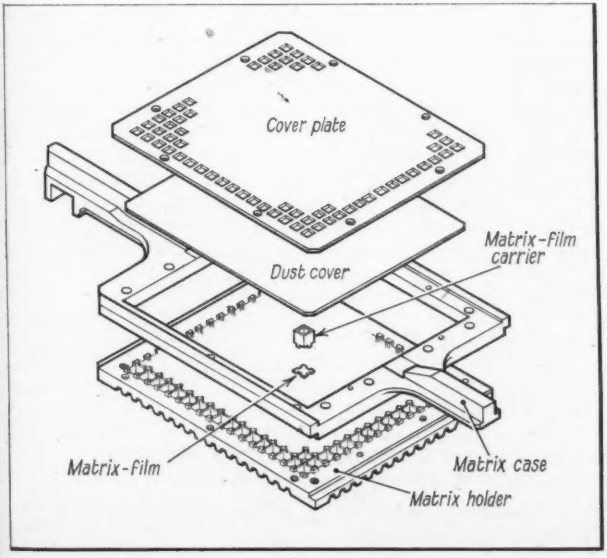


Fig. 2. Exploded perspective view of the matrix case for the Monophoto filmsetter, whereby lines of text are produced photographically on film or sensitized paper

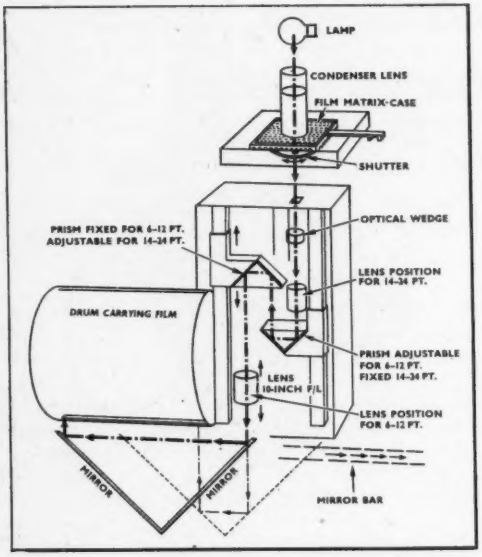


Fig. 3. The optical system of the Monophoto filmsetter, which incorporates means to compensate automatically for the varying widths of letters and to provide for different spacing of the words

mately 72 points in 1 in., and with normal spacing, the number of lines per in. is 72 divided by the point size. Thus, for 8-point type there are 9 lines per in.)

In order to produce a line of characters on the film, it is necessary to displace the projected image relative to the drum. The projected image is therefore directed on to the drum by way of two accurately positioned mirrors, which can be displaced along a path parallel to the drum axis, by the action of a mirror bar. From the diagram, it will be seen that the length of the light path from the lens to the film is constant regardless of the position of the mirror assembly. Location of the projected images to allow for the differing amounts of space occupied by each character, and "justification" of each line by providing the required amount of space between adjacent words, are effected by rack and pinion motions, which, acting through differential gearing, modify the movement transmitted from a "normal" rack to the vertical shaft that actuates the mirror bar. When each complete line of characters has been reproduced on the film or paper, the drum is automatically indexed in readiness for "setting" the next line. On the Monophoto machine, setting can be carried out at a rate of 160 characters per min., and the quality of printing when using photo-litho plates made from negatives produced on the machine is virtually indistinguishable from that obtained by orthodox methods. In order to achieve this quality, however, the components of the machine must be made to an accuracy of a very high order, and the machining of one of the most important parts—the matrix holder for the matrix case—will now be considered.

OPERATIONS ON FILMSETTER MATRIX HOLDERS

Matrix holders are made from free-cutting stainless steel (En. 56 AM), heat-treated to a tensile strength of 45/50 tons per sq. in. Some of the most important dimensions of a matrix holder are indicated in Fig. 4, and it will be observed that there are 255 holes to receive the matrix-film carriers. Each hole must be machined 0·167 in. square, to limits of +0, −0·003 in., with a maximum radius of 0·010 in. at the corners. On one side of the matrix holder there are two sets of V-grooves, which must be machined at 90 deg. to each other within very close limits, and serve to locate the matrix holder in the Monophoto machine. The pitch of these grooves must be held to ±0·0005 in., and the maximum permitted accumulative error is ±0·001 in.

Two sets of rectangular-section slots are machined in the face of the matrix holder opposite to the V-grooves, and attention is drawn to the very close limits specified for the width of these slots, also for their relationship to the V-grooves.

The operation sequence for the matrix holder provides for cutting the work-material to length and rough grinding the top and bottom faces, followed by straddle milling the side faces. Machining of the recess in one side (as indicated in the left-hand and scrap sectional views in Fig. 4) is performed at one horizontal and two vertical milling stages, and is followed by a stress-relieving treatment, after which the top and bottom faces are ground. Checking and removal of burrs follows, and the workpiece is then ready for drilling 255 holes, which are subsequently broached to the required square cross-section.

Fig 5 shows the set-up for drilling the matrix-holder blanks, and this operation is performed on an Archdale single-spindle pillar drilling machine, which is fitted with a Slack & Parr, adjustable-centre, multi-spindle head *A*. The holes are required to be drilled 0·172 in. diameter, and three ~~11~~ in. diameter drills are employed.

A fixture clamped to the machine table incorporates two slides *B* and *C*, which move on guideways at 90 deg. to each other, and three bushes for the drills are carried on a bridge member *D*.

It may be mentioned that the fixture was originally employed for matrix case cover plates, and the clamps have been retained but are not used for the cover plates now in general production. The matrix holder here considered is located and clamped on an adapter plate *E*, which is screwed and dowelled to the upper of the two slides. This adapter plate has button-type locations as at *F*, and after a work-blank has been placed on the top surface of the plate, it is thrust in two directions at 90 deg. by edge-cams, as at *G*, so that one long and one short side engage the location buttons. The edge cams are provided with finger levers, and one is positioned at the right-hand side of the adapter plate, and the other at the rear.

The top slide is moved from left to right, and the bottom slide from back to front, by means of the two levers seen at the front and left-hand side of the fixture. Each lever actuates a pair of pawls, which engage a rack with teeth of straight-sided V-form, and movement of the lever through 180 deg. and back serves to release, advance, and relocate the slide. The racks for movement in the two directions mutually at right angles are fitted to the lower slide, one pawl mechanism being housed in the upper slide and the other in the fixture base. It will be appreciated that each

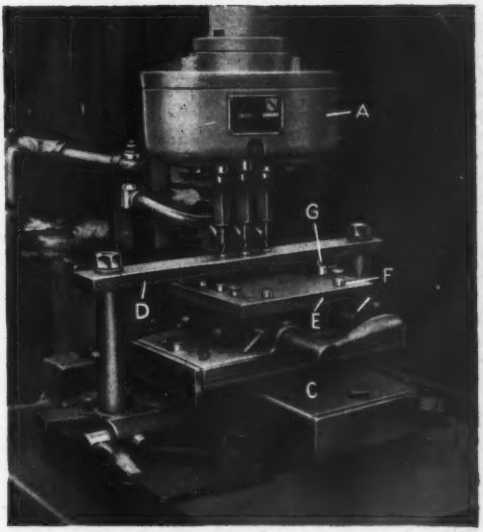


Fig. 5. This set-up, on a pillar-type machine, is employed for drilling the holes in the matrix holder prior to square-broaching operations

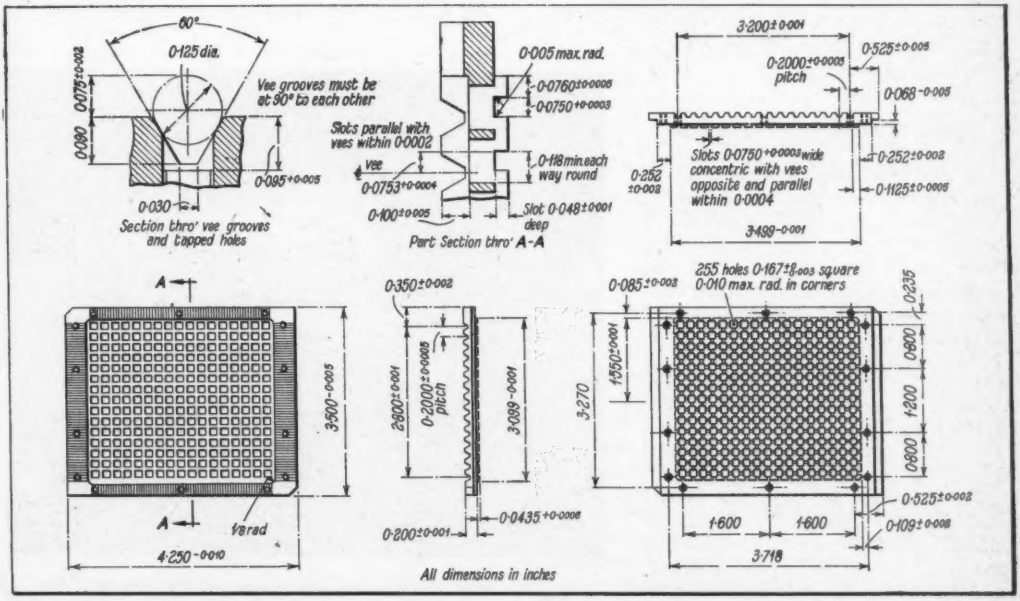


Fig. 4. Details of the matrix holder, one of the most important components in the matrix case assembly for the Monophoto filmsetter. It is made from En.56 AM stainless steel

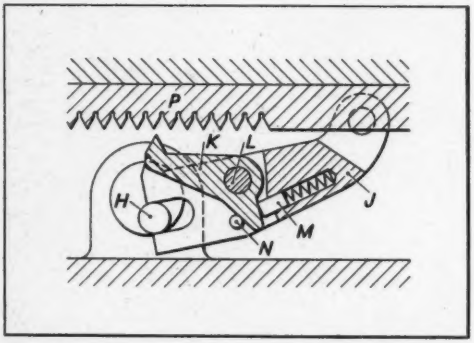


Fig. 6. Details of the pawl and ratchet mechanism incorporated in the drilling fixture for indexing the work-carrying members

slide is moved through a distance equivalent to one tooth pitch (corresponding to the pitch of the holes in the workpiece) for each complete movement of the associated lever. The rack for the lower slide has 15 teeth, but since three holes, spaced five hole-pitches apart, are drilled simultaneously, the rack for the upper slide has only seven teeth, and seven movement cycles for this slide are necessary, one hole only being drilled at each of the extreme left- and right-hand settings.

DOUBLE PAWL INDEXING MECHANISM

It may be of interest to consider the double-pawl indexing arrangement in some detail, and the mechanism is shown in Fig. 6. Each operating lever shaft has an eccentric peg machined integral with its inner end, as indicated at *H*. This peg engages a slot in the free end of the larger pawl *J*, and when the lever is swung through 180 deg., and returned, the pawl is lowered and raised. One end of the pawl *J* is of bifurcated form, and between the two arms is housed a smaller pawl *K*, which is pivoted on a pin *L*, that passes through the arms. A tooth, of straight sided V-form is machined at the free end of the smaller pawl *K*, and when the latter is assembled to the larger pawl *J*, the tooth can be swung into alignment with two similar teeth on the free ends of the arms.

A spring pad *M* in the pawl *J* is thrust against an extension on the pawl *K*, so that the latter is urged in a clockwise direction relative to the pawl *J*. This movement is limited by a transverse pin *N* in the larger pawl. When the operating lever is moved through 180 deg. during the first half of an indexing cycle, the eccentric peg *H* is swung from its uppermost setting to the position shown, and the two pawls are lowered out of engagement with the teeth provided on the rack *P*.

The action of the spring pad *M* then causes the smaller pawl *K* to move relative to the larger pawl *J*, until its extension contacts the transverse pin, and at the end of the lever movement, the pawl *K* is in the position shown. As the lever is turned through 180 deg. in the reverse direction, the two pawls are raised. The setting of the smaller pawl is such, however, that as it is lifted, its tooth engages a space in the rack adjacent to that with which it was originally in mesh. As upward movement continues, the two pawls act as a toggle linkage, and thrust is applied to the rack by the smaller pawl, to move it to the left (as viewed in the illustration). Towards the end of the movement, the teeth on the larger pawl enter the tooth-space on the rack which is engaged by the smaller pawl, the latter moving relative to the larger pawl against spring pressure. At the end of the upward motion, the teeth on both pawls are fully engaged with the

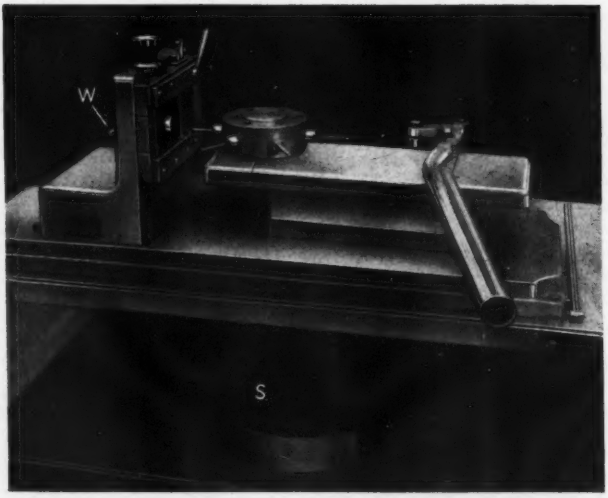
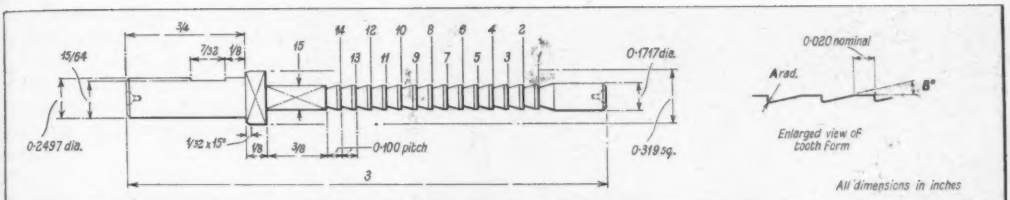


Fig. 7. This manually-operated equipment, for broaching the holes in matrix holders after they have been drilled, incorporates the turret slide from a capstan lathe. Broaches mounted in the turret are indexed in succession to the working position



	DIMENSION ACROSS FLATS OF EACH SQUARE CUTTING TOOTH (IN)															Tooth Radius A (in)	Tooth Angle B (deg)
Tooth No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Broach No. 1	0·122	0·123	0·124	0·125	0·126	0·127	0·128	0·129	0·130	0·131	0·132	0·133	0·133	0·133	0·130	0·008	15
" " 2	0·133	0·1339	0·1348	0·1357	0·1366	0·1375	0·1384	0·1393	0·1402	0·1411	0·1420	0·143	0·143	0·143	0·140		
" " 3	0·143	0·1439	0·1448	0·1456	0·1464	0·1472	0·1480	0·1488	0·1496	0·1504	0·1512	0·1520	0·152	0·152	0·149		
" " 4	0·152	0·1526	0·1532	0·1538	0·1544	0·1551	0·1558	0·1565	0·1572	0·1579	0·1586	0·1593	0·160	0·160	0·157	0·015	22
" " 5	0·160	0·1605	0·1610	0·1615	0·1620	0·1625	0·1630	0·1635	0·1640	0·1645	0·1650	0·1655	0·166	0·166	0·163		

Fig. 8. Details of the high-speed steel broaches employed to produce the square holes in matrix holders

tooth-space to lock the rack and its associated slide in the new position.

With the equipment described, holes are drilled at 0·2-in. pitch in each direction, the tolerance on the pitch being ±0·003 in., and the maximum cumulative error over a complete row of holes, 0·003 in. The rows of holes must be parallel to one long side and one short side within 0·001 in., these sides being used as datum faces for the machining operations on the workpiece. During drilling, soluble oil coolant is directed on to the tools and work by way of three nozzles on a manifold pipe at the rear of the fixture. Drilling is performed at a spindle speed of 955 r.p.m., with hand feed, and the machining time that is required for the 255 holes is 22 min.

BROACHING THE HOLES

From the drilling machine, matrix holder blanks are passed to the special broaching equipment seen in Fig. 7. This equipment was built by Monotype Corporation, Ltd., and incorporates a capstan slide assembly from an old Warner & Swasey lathe. Broaching of each drilled hole in a workpiece is carried out in five stages, and tools are mounted in five of the bores in the turret on the slide assembly, the sixth bore being fitted with a cylindrical pilot pin. The pin, of 0·1717 in. diameter, is a slide fit in the drilled holes, and is used for initial setting. Each broach has a plain cylindrical end, which is held to 0·1717 in. diameter, as seen at the right-hand end in Fig. 8, which gives details of the broach teeth.

It will be seen that each broach has a large end of 0·2497 in. diameter, which is a sliding fit in the adapter fitted to the bore of the turret. The broach is held in the correct angular setting by a larger square shoulder, of 0·319 in. across flats, which engages an accurately cut slot in the end face of each adapter. When the broaches are set up, the alignment of the outer cylindrical ends, also that of the pilot pin, is checked by means of a dial indicator gauge, and corrected if necessary.

The broaches are made from high-speed steel, and it has been found that twenty workpieces can be machined—a total of 5,100 holes—before regrinding of the cutting edges is necessary. A suitable cutting oil is applied to the teeth with a brush during the operation and when the broaching equipment is not in use, the broaches are protected by a cylindrical cover *S*, Fig. 7. Broaching is performed by moving the capstan slide to and fro by hand, and at the end of each return stroke, the next tool is automatically indexed into the cutting position. It will be observed that the capstan-slide operating lever has been extended by the addition of a length of steel tube, in order to reduce operator fatigue.

BROACHING FIXTURE DESIGN

Fig. 9 is a close-up view of the fixture in which the matrix holder blanks are mounted for broaching. It incorporates a massively-proportioned cast angle plate, which is secured to the baseplate whereon the capstan slide is mounted. A carriage *T* moves on hardened steel, vertical guide-members, as at *U*, inserted in slots in the angle plate, and it can be traversed by turning the hand-knob *V*, which is connected to a screw. The carriage can be clamped in position by means of a screw at the rear of the angle plate, the hand-lever of which is just visible at *W* in Fig. 7.

On the carriage there are horizontal guideways for a slide *X*, Fig. 9, and this slide can be located

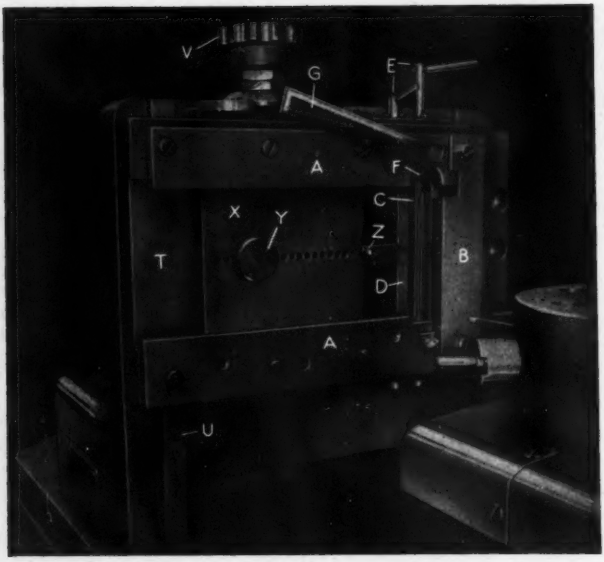


Fig. 9. Close-up view of the indexing fixture for the broaching operation. Transverse settings are obtained by means of jig-bored holes and an index pin, and the vertical settings are made with a slip gauge and dial indicator

transversely on the carriage by a hardened pin, provided with a large knurled knob *Y*. There are 17 jig-bored holes in the slide, to correspond with the number of rows of holes in the workpiece, and the pin is passed through one of these holes into a hole in the carriage.

The slide is removed for loading the work, and a matrix holder blank is inserted between the guideways of the carriage, after which the slide is replaced, and the location pin is engaged with the hole at the extreme right-hand end. At this end, there is an abutment screw *Z*, against which the short datum edge of the workpiece is held, and the longer datum edge rests on the side face of the lower guideway. Thus positioned, the blank is correctly set for broaching the first hole of a horizontal row of 17. The blank is a loose fit between the carriage and the inner faces of the retaining strips *A* (for the slide) and the bridge member *B*, these faces being in the same plane. A clearance slot *C* is machined in the carriage, for the passage of the broaches, and there are pockets at either side of the slot which house pads, as at *D*. These pads are thrust back into the pockets by leaf springs, and can be advanced by cams actuated by the handles *E*, to clamp the workpiece securely against the retaining strips *A* and the bridge member *B*. An upper clamp pad *F* can be moved downwards by the lever *G* to hold the datum edge of the workpiece against the lower side face of the slideway.

Holes in a horizontal row are broached in succession, the workpiece being indexed sideways by moving the locating pin from one hole in the slide to the next. After each horizontal row has been completed, the carriage is moved downwards, and is approximately positioned for the next row by reference to an index mark on the hand-knob *V*. For the final setting of the carriage, a reading is taken with a dial indicator gauge on a 0·2-in. slip gauge, placed on the upper edge of the lower retaining strip *A*, and is compared with the reading obtained from the edge of the strip before the carriage was moved downwards.

A broached matrix holder blank is seen at the lower centre in Fig. 10, and it may be noted that there is a witness of the original drilling in each hole. Blanks are broached in batches of 100, and the time required for the complete loading, positioning and broaching cycle on each blank is about 4 hours. The company has considered the possibility of providing a fully automatic machine for this work, but it has been decided that such a machine could not yet become economically justified, particularly as an operator would be required for monitoring duties. The pitch of the holes in both directions is 0·2 in. ±0·0025 in., and the maximum cumulative pitch error is ±0·0025 in.

GROOVE AND SLOT MILLING OPERATIONS

After the holes have been broached, the matrix holder blanks are subjected to 100 per cent inspection, followed by a straightening operation and another inspection. Two further milling operations are then performed on the recess in one side, and the components are next heat-treated to relieve stresses. An inspection stage follows, after which the two datum edges are ground to specific dimensions from the adjacent rows of holes. The tolerance on each of these dimensions is 0·0005 in.

Grinding completed, the blanks are ready for the milling of the V-grooves in the recessed side, and this operation is performed in two stages. The transverse grooves are machined first, followed

by the lengthwise grooves, each stage being carried out on a complete batch of parts. A component after both stages have been performed is seen at the upper right in Fig. 10.

Simple fixtures are used for both milling stages, for which Brown & Sharpe No. 000 automatic horizontal-type machines are employed. The work is located from the datum edges, and the grooves are produced by gang milling. A tolerance of 0·0005 in. is maintained for both the pitch of the grooves and the cumulative pitch error, and the cutter gang is built up on a tubular arbor, which is a sliding fit on the solid arbor fitted to the cutter spindle of the machine. Cutters are carefully selected and adjusted to maintain the required tolerances, and the teeth are staggered in helical formation in order to reduce vibration to a minimum.

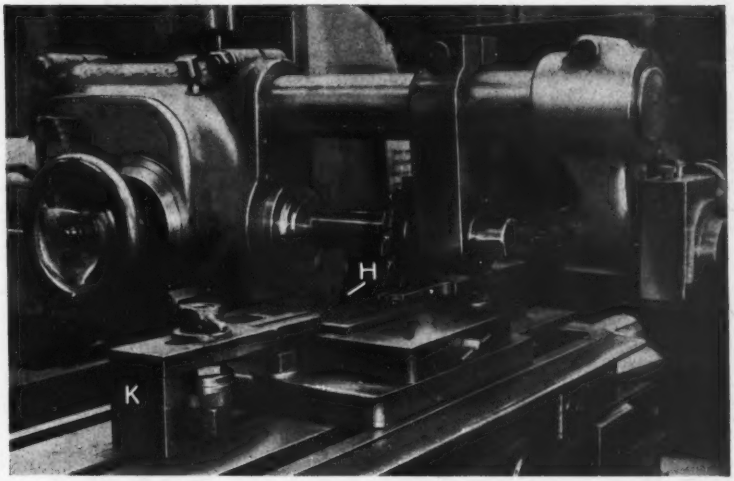


Fig. 11. Set-up for milling the rectangular-section slots in matrix holder blanks. Each blank is located by a spring-loaded strip in the fixture that engages one of the previously-machined V-grooves

Machining of the rectangular-section slots in the opposite face of each component is also carried out in two stages, after further milling and straightening operations have been performed. Two similarly-equipped Brown & Sharpe machines are used, each of which provides for milling the slots in one direction. The set-up for milling one set of slots is shown in Fig. 11, a workpiece being indicated at *H*. A simple fixture *J* incorporates a steel strip, which is urged upwards by springs. This strip is machined to a V-section along its upper edge, and the fixture is set on the machine table so that this edge is accurately aligned with the direction of table travel. A workpiece is loaded with the recessed face downwards, and the first of the series of V-grooves in one direction across this face is engaged with the tongue. The workpiece is then secured by clamps, as at *K*, and as

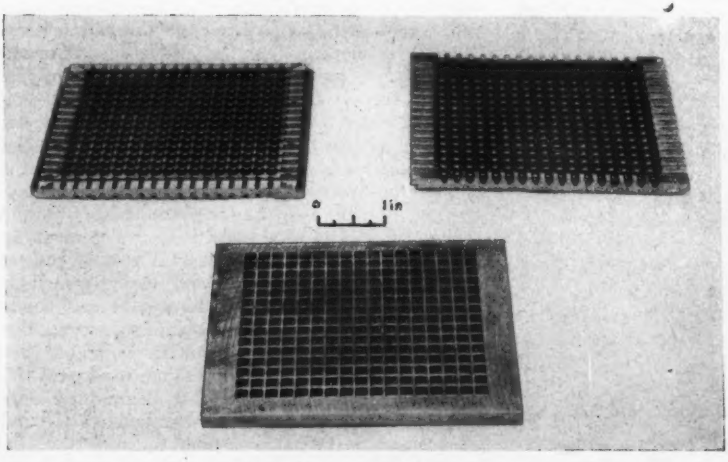


Fig. 10. Matrix holder blanks are seen after the broaching operation (lower centre), after the V-grooves have been milled (upper right), and after the rectangular-section slots have been milled

the component is thrust downwards on to the upper surface of the fixture, the steel strip is depressed against spring pressure.

Climb milling is employed, with cutters made by the Monotype Corporation. Each cutter has 12 teeth with brazed-on tips of Prolite type 8K tungsten carbide, and details of the cutter design are given in Fig. 12. Slot milling is performed on both machines at a spindle speed of 240 r.p.m., and a table feed rate of 1¾ in. per min., the cutters being re-sharpened after 15 components have been completed. Milling is performed without the use of coolant, since it has been found that if oil is present the slots are machined oversize by a varying amount. A component after the two slot-milling stages is seen at the left in Fig. 10.

MODIFICATIONS TO MILLING MACHINE

The Brown & Sharpe No. 000 plain milling machines employed operate on an automatic cycle, and, on each machine, the table is advanced towards the cutter at the rapid traverse rate of 365 in. per min. when the "start cycle" button is pressed. A trip dog in a T-slot at the front edge of the table engages the cutting feed motion, and,

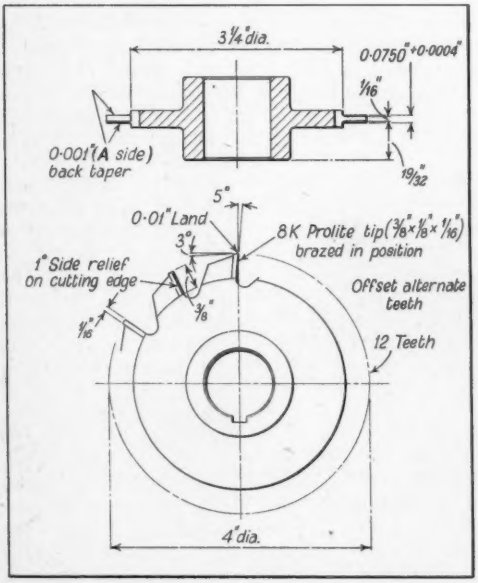


Fig. 12. Details of the cutter used for milling the rectangular section slots. Of alternate, side and face type, it has teeth tipped with Prolite carbide, and is made by the Monotype Corporation

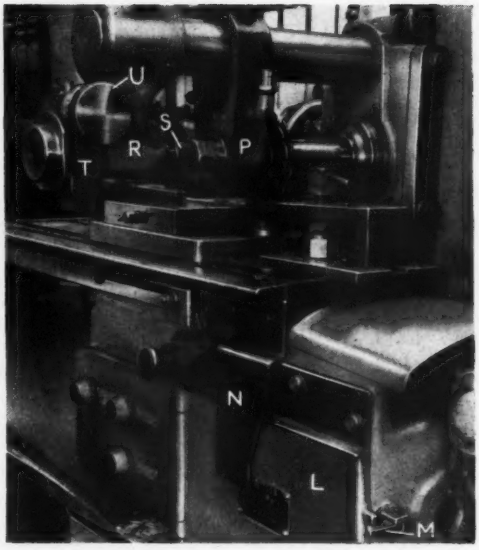


Fig. 13. For the slot and groove milling operations, Brown & Sharpe machines have been specially modified by the Monotype Corporation to facilitate cutter setting, and to provide for automatic stopping at the end of the cutting traverse

normally, the table is automatically returned at the rapid rate, on completion of the cutting traverse. To prevent damage to the milled grooves and slots, however, the Brown & Sharpe machines have been modified by the Monotype Corporation, so that the tables stop at the end of the cutting traverses. The workpieces are then removed, and the rapid return traverses are engaged by the operators. When cutting the rectangular section slots, which are milled one at a time, the work is replaced in the next groove position, after the table has been returned.

A simple but very effective arrangement is employed to achieve the desired result, and is based on the fact that the feed change gears on each machine are housed behind a hinged cover at one end of the bed, the cover being electrically interlocked so that the machine is stopped if the cover is opened. The cover is indicated at *L* in Fig. 13, and it is retained in the closed position by a hook-type catch *M*. A cranked steel plate *N* is secured to the machine table by screws, which pass through elongated holes to provide for length-wise adjustment. The setting of this plate is such that at the end of the cutting traverse, the lower

end of the plate engages the catch *M*, and swings it sideways. Under the action of a spring, the cover *L* is opened, and the machine is stopped by the electrical interlocking arrangement. The shape of the plate *N* is such that the cover can only swing open sufficiently to trip the interlocking switch, and not enough to enable the operator to gain access to the feed gear chamber. After the workpiece has been removed, the clamps of the fixture are tightened on to the spring-loaded locating strip to thrust it downwards clear of the cutter. The machine cycle is then re-engaged by the operator closing the cover *L*, with the result that the table is returned at the fast rate to the starting position. It will be appreciated that when the table has moved through a small distance to the left, the catch *M* can swing back to its original position, in which it serves to hold the cover *L* closed.

The table of the Brown & Sharpe machine does not move transversely, and the cutter spindle is mounted in a quill which can be adjusted by graduated hand-wheel, acting through a rack and pinion. To facilitate accurate setting of the cutters in relation to the fixtures, the machines employed for groove and slot milling have been arranged for micrometer adjustment by the Monotype Corporation. On each machine, a spring has been fitted to the spindle head to urge the quill outwards. As may be seen from Fig. 13, the cutter arbor is supported by an intermediate bearing *P*, and an outer steady bracket *R* is mounted on the overarm. This bracket is fitted with a screw, on the end of which is mounted a knurled sleeve *S* containing a thrust race, comprising six steel balls in a brass cage. A worm wheel is keyed to the outer end of the screw, and is engaged by a worm in the housing *T*, the end of the worm shaft carrying the micrometer drum *U*. By turning the drum in one direction or the other, the cutter spindle can be moved inwards or outwards, and fine setting is facilitated by the worm reduction drive to the screw, and the calibrations on the drum.

Matrix case blanks are straightened after each slot milling stage, and machining is completed by a further series of operations, which include milling the steps and chamfers, drilling and tapping the holes, and grinding certain areas employed for location purposes. Finally, each matrix holder is carefully deburred, straightened, and checked.

PRESS TOOL FOR COVER PLATES

Reference was made earlier to the cover plate for the matrix case assembly (see Fig. 2). Cover plates are made from $\frac{3}{32}$-in. thick, hard temper, steel strip to En.2 specification, and the production sequence provides for piercing 255 square holes to match those in the matrix holder. The holes must be 0·175 in., +0, −0·003 in. square, and the pitch in each direction must be 0·2 in., ±0·002 in., with a cumulative error of ±0·002 in.

Piercing of the holes is carried out in two stages, and a cover plate at the end of the first stage is seen at the left in Fig. 14. To permit the use of a press tool of adequate strength—since there is only 0·028-in. thickness of metal between the holes—alternate holes are pierced in adjacent rows, across the strip, at the first stage. In consequence, after this stage, there are 13 complete rows of 15 holes, one end row of eight holes and one end row of nine holes. Piercing of the remaining holes in the end rows is carried out at a subsequent stage to produce a cover plate as seen at the right. Attention is drawn to the slight concavity of the cover plates, which is specified as $\frac{1}{16}$ in. at the centre of an inscribed circle of 3 in. diameter.

The first press tool is seen in Fig. 15, and it will be observed that it has a base, made from steel plate, whereon is mounted a Desoutter die set, with light top and base members. Guide strips, of L-shaped cross-section, are mounted on the die-set base, and between the strips slides a nest plate *V*.

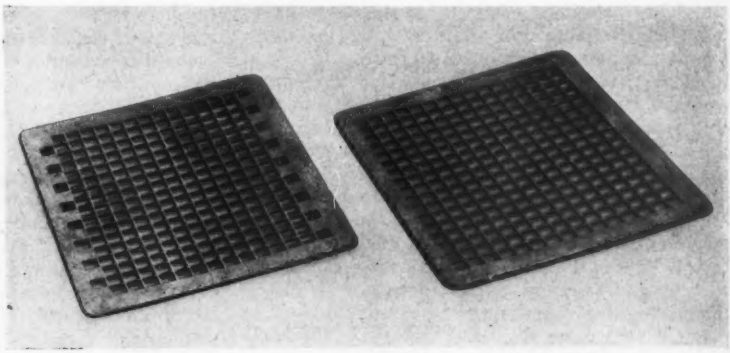


Fig. 14. Cover plates for matrix case assemblies are here seen after the first piercing stage (left) and after piercing has been completed (right)

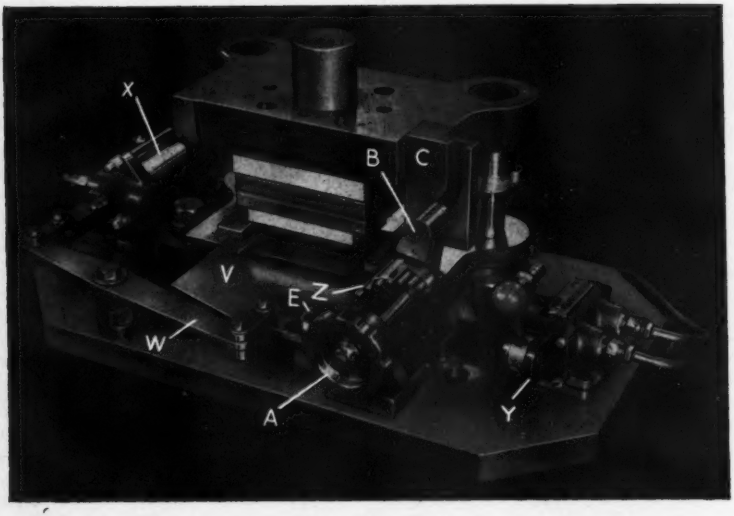


Fig. 15. This indexing press tool is employed for the first pressing stage on covers for matrix case assemblies. Alternate holes are pierced in two adjacent rows simultaneously

A rectangular aperture is machined in the nest plate to receive a blank workpiece, which is then located between a die assembly, let into the die-set base, and a punch and stripper assembly mounted on the die-set top member. The nest plate is connected by links and a lever *W* to a double-acting Schrader air cylinder *X*. Pressure air is directed to one end of the cylinder or the other by the Schrader lever-actuated valve *Y*, and with one setting of the valve, the nest plate is pulled outwards from the tool, to the position shown. This position is controlled by one end of a slot in the nest plate, making contact with a stop peg in the die set base, and with the plate thus withdrawn, a work blank can be readily loaded into the aperture.

At one side of the tool there is a stop drum assembly, which incorporates a drum *Z*, with four step faces along its length. The outer end of the drum serves as a datum face, and from each step face, stop pegs project, the ends of which are ground to increasing distances from the datum face, in increments of 0·2 in. (the pitch of the holes to be pierced in the workpiece). The total number of pegs is 13, and the stepped form of the drum avoids the use of any pegs of excessive length.

The stop drum can be rotated by a hand knob *A*, pinned to the drum shaft, and the boss of the knob has 14 dimples, which are engaged by a spring-loaded ball housed in the bearing bracket for the drum. Ratchet teeth are machined on the flange at the inner end of the drum, and on the end of the drum shaft that projects beyond the bearing bracket, a lever *B* is freely mounted. At the upper end of this lever there is a pivot pin, that carries a roller which rides in the dog-leg track in the cam plate *C*. This plate is screwed to the side of the die-set top member, and has elongated screw holes that provide for limited vertical adjustment.

A pawl is housed in the enlarged upper end of the lever *B*, as seen in *D* in the scrap view *x* in Fig. 16, which has been lettered to correspond with Fig. 15. A small leaf spring urges the pawl into contact with the ratchet teeth on the end of the stop drum Z. It will be evident that as the upper tool assembly is moved up and down with the press ram, the lever *B* is oscillated by the dog-leg cam track, and towards the end of each upward movement, the stop drum is indexed through 15 deg.

At the start of a piercing cycle, after a work blank has been loaded, the valve *Y*, Fig. 15, is re-set, and the air cylinder *X* moves the nest plate inwards until an abutment block *E* (of L-shaped form) contacts the datum face on the stop drum. Drive to the press ram is then engaged, and the ram moves down so that the punches in the upper tool assembly pierce eight of the first row holes, and nine of the second row holes, in the workpiece. As the ram rises, the stop drum is indexed by the pawl and ratchet mechanism to align the first stop peg with the abutment block, and the nest plate and work are advanced by the air cylinder until the block contacts the peg. During the next downward stroke of the ram, eight holes are pierced to complete the second row in the workpiece, and nine holes in the third row are pierced. Indexing of the stop drum and movement of the nest plate continue until 14 cycles have been completed, and the abutment block is in contact with the shortest peg on the innermost step. At this setting, the workpiece is positioned for completing the fourteenth row of holes, and piercing nine holes in the fifteenth row. As the ram rises after piercing these

holes, the operator disengages the drive to the press. If he should fail to do so, the pawl moves over a plain portion of the drum flange so that no further indexing motions take place. The operator then returns the valve *Y* to its original setting, and the nest plate is withdrawn to permit the work to be unloaded. Finally, the operator turns the stop drum by means of the hand knob, to bring the datum face of the drum into the position in line with the abutment block *E*.

Details of the construction of the cutting elements of the press tool are given in the views at *y* and *z* in Fig. 16. The die is built-up from three pieces of Kayser, Ellison KE. 595 alloy tool steel, to enable the apertures for the square holes in the work to be ground. One die member *F* has eight slots, 0·178 in. square, and the die member *G* has nine slots of similar dimensions, also a shallow step, as seen in the sectional view at *z*. The third die member, *H*, is a strip, corresponding in thickness to the metal between the holes in the work, and it rests on the step face of the die member *G*, and is clamped between the two larger members.

The punches (as at *J* in view *z*) are of conventional design with cylindrical bodies and square-section ends, and are made from Kayser, Ellison KE. 672 die steel. There is 0·002 in. clearance between the punches and the die apertures, and the end faces of the punches are ground to provide shear, the punch faces in the centre of the tool being $\frac{1}{16}$ in. lower than those at the outside. The punches are a slide fit in the stripper plate *K* (view *z*), which is supported on shoulder screws and is backed up by a thick pad of rubber.

Further articles concerned with production operations at the Salfords factory of the Monotype Corporation will be published shortly in MACHINERY.

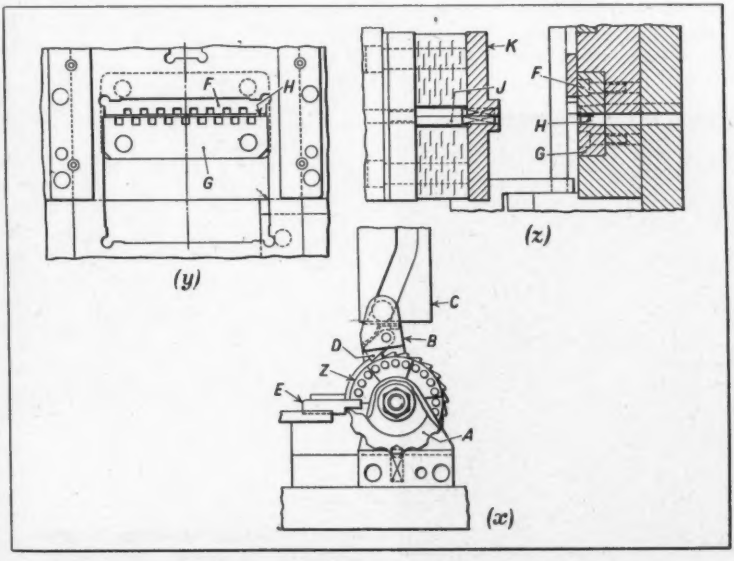


Fig. 16. Details of the pawl and ratchet mechanism for the indexing press tool are seen in view *x*. The views *y* and *z* show the punch and die assemblies, and the rubber-loaded stripper

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HIRD-BROWN PHOTO-ELECTRIC WARNING DEVICE. A photo-electric device which will give warning of the slowing down or stopping of machinery used in continuous processes is now being produced by Hird-Brown, Ltd., 244 Marsland Road, Sale, Cheshire.

The device, which can also sense changes in rotation or other movement, is primarily intended for application where machinery is left untended, and it can be used to monitor the movements of conveyors, rotating shafts, fans, rollers, press rolls, reciprocating shafts, levers and crank arms, for example. It is enclosed in a dust-tight housing, to withstand industrial conditions.

There is no mechanical connection with the monitored drive, or mechanism, and it is stated that installation is extremely simple. The unit has been designed to fail safe and to give warning in the event of a component failure.

Operation of the device depends on repeated regular interruptions of a light beam which keep a relay energized. Should the interruptions fall below a pre-determined speed, or stop with the light beam broken or unbroken, the relay will operate an alarm or initiate correction. Magnetic sensing heads are also available.

THE VALUE OF EXPORTS OF MACHINERY, other than electric, during February, 1961, was £67,330,408 as compared with £55,849,260 for February, 1960.

Typical Machining Operations on Aluminium Cylinder Heads

In MACHINERY, 98/369—15/2/61, reference was made to the Buick V-8, type 4,100 engine, of 215-cu. in. displacement, for which aluminium is largely employed, and some examples of machining operations on the cylinder block were considered. A similar engine is employed for the Oldsmobile F-85, 6-passenger car, and the cylinder blocks are produced on the same line at the General Motors Corporation works at Lansing, Mich., U.S.A.

Unlike the Buick version, however, the Oldsmobile engine has aluminium cylinder heads, which are produced by gravity die casting with sand cores. For machining these heads, a special line has been installed in the Oldsmobile No. 3 works, each section of which is new, apart from an 11-station machine by W. F. & John Barnes, for finishing valve seats and guides, which was rebuilt by F. Jos. Lamb. In planning this line, due consideration had to be given to the special requirement for machining aluminium, and particularly to the provision of an adequate coolant supply. Owing to the high rates of metal removal that are obtainable, quantities of light, flaky chips tend to pile up on the transfer rails, and to cling to the machine heads and castings. To wash away the swarf, and to cool and lubricate the tools, coolant (28 parts water to 1 part WA-159 plus 1 part C-60) is supplied to the line at the rate of 3,000 gal. per min. Of this flow, approximately one-third is required for cooling purposes, and the remainder serves to wash chips from the workpieces and working areas.

There are two tanks below floor level, at the starting end of the line. Chips and coolant flow into the first, or settling, tank, which has a capacity of 35,000 gal. When most of the chips have settled out, the fluid is pumped through a Hydromation unit where the remaining chips and sludge are trapped by large rolls of filter cloth. The clean coolant is then delivered to a 6,000-gal. capacity tank for redistribution to the line.

MILLING AT HIGH CUTTING RATES

At the starting end of the line there is a 7-station Snyder transfer machine on which five main surfaces are milled. At the first station, seen in Fig. 1, the cover face and the exhaust and bolt bosses are finished. These surfaces are indicated by heavy lines at *A* in Fig. 2. Three inserted-tooth (grade C-2 carbide) cutters are used—one vertical (5-in. diameter, 10 teeth), one horizontal (3·625-in. diameter, 4 teeth), and one at an angle of 48 deg. (4-in. diameter, 8 teeth).

The cutting speed for all three cutters is 2,075 ft. per min. with a feed rate of 159 in. per min. As the casting approaches the cutters, the spindle heads are traversed with it. The casting is then brought to rest, is locked in position, and the spindle heads are traversed in the opposite direction at the selected feed.

An idle station follows, after which the heads are swivelled through 90

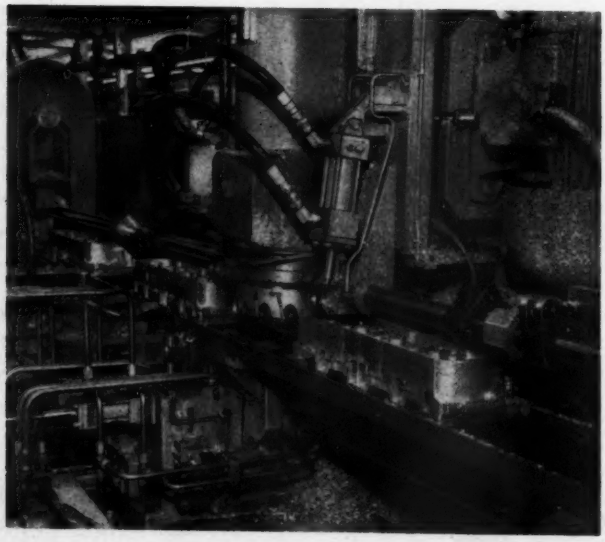


Fig. 1. The first operations on the cylinder head casting are performed on this 7-station transfer machine. Three cutters mill the cover face and exhaust and bolt bosses

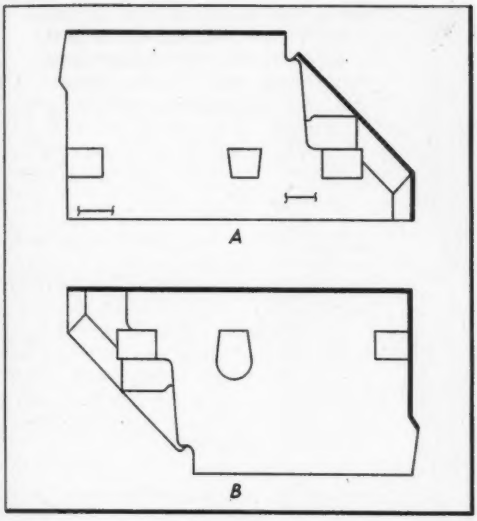


Fig. 2. In the first section of the cylinder head transfer line, surfaces indicated by heavy lines at *A* are machined at station 1, and those indicated at *B*, at station 6

deg. to bring the joint face to the left and the intake manifold face to the top. At another station in this first section, after the heads have again been swivelled through 90 deg., the main joint surface and the intake manifold faces are milled as indicated at *B* in Fig. 2. For the joint surface an 8-in. diameter cutter is run at 2,000 ft. per min. A 4-in. diameter cutter machines the manifold faces at 2,075 ft. per min., the feed rate for both cuts being 159 in. per min.

Next in the line there is a 13-station Footburt transfer machine on which various operations are performed on the cylinder head. Every second station is idle, leaving six where work is done.

At the first working position (station 2) a pair of 8-in. diameter Ingersoll Shear-Clear face mills is advanced from the left-hand spindle head to straddle-mill six end pads. These cutters are fed at 90 in. per min. and run at 1,040 ft. per min. At the same time, the 13 holes are drilled by the opposite spindle head, two of which are then countersunk. For the majority of drilling and countersinking operations, sub-land drills are used. To ensure rapid chip discharge from the holes, drills of high-spiral design have proved most satisfactory. These drills have polished flutes with large radii, and narrow lands—approximately 0·015 in.—to prevent loading and consequent production of oversize holes.

Other sub-land drills are employed at the next machining position (station 4). where the left-hand spindle head provides for drilling and countersinking eight holes in the exhaust mounting bosses. The right-hand head at this station carries 10 tools, as seen at the left in Fig. 3, for drilling four bolt holes and reaming six other holes which were drilled at the previous stage (four locating holes and two holes for dowelling the head to the block). The casting seen on the transfer rails at the right is at the idle station between working stations No. 4 and 6. This station is typical of the idle positions, numerous tubes being carefully arranged to direct a flood of coolant not only over the entire cylinder head, but also into the holes or against the areas that have just been machined to flush out the aluminium chips. (For the sake of clarity, coolant flow has been shut off in each of the illustrations.)

At station 6, 26 holes are drilled and five are

Fig. 3. Four bolt holes are drilled and six are reamed in the joint-face area by tools in the head at the left. At the idle station on the right, the casting is flushed with coolant to remove aluminium chips

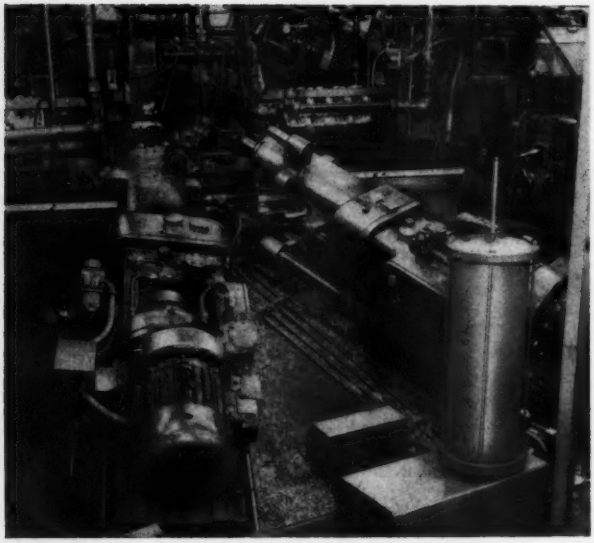


Fig. 4. At this station four sparking plug holes are drilled in the head at compound angles. The inclined positions provide for clearance between the plugs and the exhaust manifold

countersunk, and at station 8, the four sparking plug holes are drilled from the right-hand side of the line.

Sparking plugs for the Rockette engine are inclined at two different angles to the head to provide clearance for the exhaust manifolds. The drill heads, as shown in Fig. 4, are arranged accordingly. Each of the two heads is set at a compound angle —45 deg. up from the horizontal and 30 deg. to the left or right. Two spindles on each head carry combination tools for drilling ⅝-in. diameter holes and cutting 0·040-in. by 45-deg. chamfers at the same pass, at a speed of 150 ft. per min. At the same time, a head on the left-hand side of the line taps 15 holes, including eight exhaust manifold mounting holes and five valve-cover mounting holes.

When the head is transferred to station 10, one pair of sparking plug holes is counterbored to 0·875-in. diameter, countersunk to 0·594-in. diameter by 90 deg., and reamed to 0·505/0·500-in. diameter. All three operations are performed by a special tool. Simultaneously, four 0·250-in. diameter holes are drilled in the joint face.

The remaining pair of sparking plug holes is counterbored, countersunk, and reamed at station 12. From the rear, however, four taps are applied to cut the 14-mm. sparking plug threads. On this transfer line, Threadwell high-spiral Turbo-Cut taps are employed, which have a 52-deg. spiral angle, again to provide for rapid chip removal.

Next in the line is a second Footburt machine, which has 17 stations. Here, again, every second station is idle. When the casting enters this section it is tipped forward through an angle of 14 deg. to bring the valve-guide holes into the horizontal position. At station 2 the left-hand spindle head drills the eight valve-guide holes, while the opposite head, seen in Fig. 5, provides for finish-boring, rough-counterboring, chamfering, and

Fig. 5. These stub tools machine four alternate valve-seat recesses. The operations performed comprise finish-boring, rough-counterboring, chamfering, and spot-facing

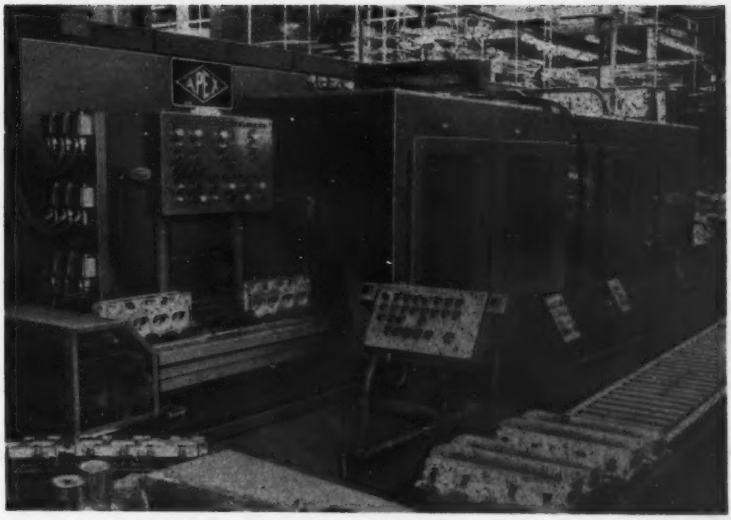


Fig. 6. Transfer type, 10-station impregnating machine for sealing castings which are leaking or porous. Sodium silicate is applied at a pressure of 100 lb. per sq. in.

spot-facing four alternate valve-seat recesses. As stub tools are used for machining the valve seats, no support bushings are required.

Corresponding cuts are taken on the remaining four valve-seat recesses by tools on the right-hand head at station 4. Simultaneously, 14 areas on two other faces of the casting are Spot-faced.

Tools at stations 6 and 8 perform identical operations, but on alternate holes. One spindle head at each position provides for trepanning four valve-spring seats and semi-finish-boring (with single-point tools) the guide holes. The other spindle head carries tools for finishing the counterbores for the valve-seat inserts. Subsequently, all eight guide holes are finished-reamed at station 10 to 0·656/0·657 in. Stations 12, 14, and 16 provide for counterboring on the intake face, and drilling, countersinking and tapping two holes in one end face.

At the end of the first leg of the U-shaped line, the aluminium cylinder heads pass through a Centri-Spray washer, where all traces of coolant and loose metal particles are removed. Two Beach units at the starting end of the second portion of the line test the heads, to determine the presence of either direct leakage or excessive porosity. All necessary passages are automatically sealed when the unit is actuated, and compressed air is admitted into the water jacket and the combustion chambers to a fixed pressure. If there is no noticeable drop in this pressure during a holding period, the cast-

Fig. 7. This 7-station assembly machine provides for the insertion of cast-iron valve-seat inserts and valve guides. Vibratory hoppers on the upper right deliver the valve guides

ing is automatically stamped as being acceptable and continues along the line.

On the other hand, too rapid a fall in the pressure of the trapped air indicates unacceptable leakage or porosity. Rejected cylinder heads are directed by way of a branch conveyor to the automatic 10-station Apex impregnating machine shown in Fig. 6. Here, the defective castings are sealed with sodium silicate under a pressure of 100 lb. per sq. in. The castings are then flushed with water, and dried with an air blast. Further drying then takes place in air at room temperature for a period of 16 hours before the castings are re-checked on the Beach units.

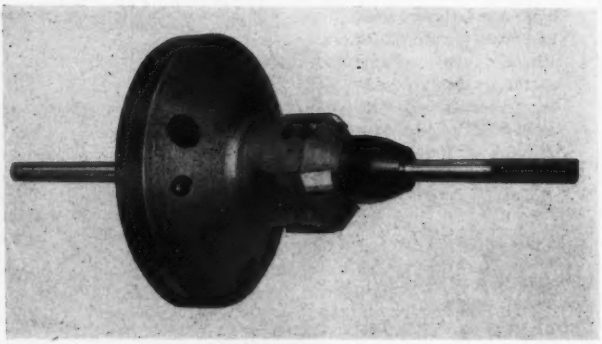


Fig. 9. This coaxial tool plunge-cuts the valve seat and gun-bores the valve guides at one pass. The boring tool, with a solid-carbide tip, is fed through a carbide nose bushing after the valve seat has been finished

Cast-iron valve-seat inserts and valve guides are pressed into the aluminium heads on the 7-station Parker transfer machine shown in Fig. 7. Of the seven, four are working stations. One pair of valve seats and one pair of valve guides are inserted at each of these positions, two cylinders being handled at a time.

Valve seats are fed from manually loaded magazines, two of which are indicated at *A*, Fig. 8. A shuttle then carries the inserts to the left and positions them beneath individual rams which press them into the machined recesses in the heads.

The operating cycle of the rams comprises three phases. First, low pressure is applied. If the insert is driven home at this stage the fit between it and the head is too loose and the assembly is rejected. Next, a specified pressure is built up and the insert should then be seated correctly. If it is not driven home, the assembly is rejected because the fit is too tight. Finally, high pressure is applied to the ram for "ironing" the valve-seat insert in position.

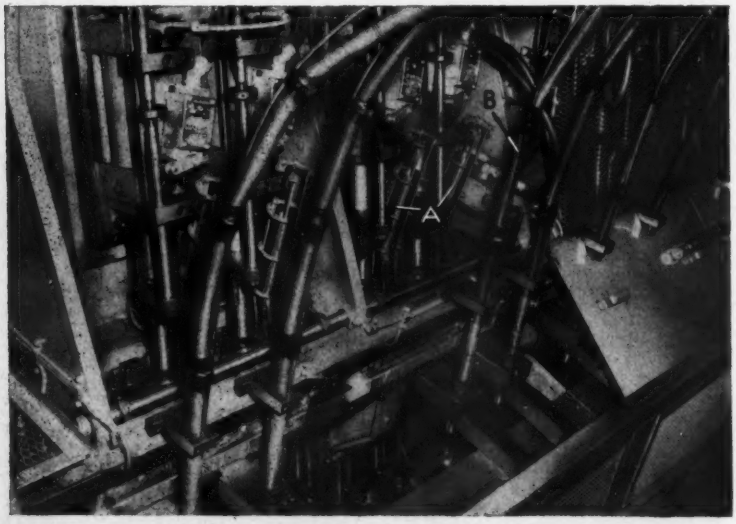


Fig. 8. Valve guides are delivered through flexible tubes as at *B* to a position below the casting. Seat inserts are fed from the magazines *A* to a position above the casting. Rams are then operated to drive the inserts into the head

Valve guides of cast iron are delivered from two Syntron vibratory hoppers above a separate platform, at the right in Fig. 7. They are gravity-fed through flexible tubes *B*, Fig. 8, to a shuttle below, and in front of, the casting. The shuttle brings the guides into alignment, and they are then engaged by rams and pressed up into the reamed guide holes in the cylinder head.

Valve guides and seats are subsequently finished on an 11-station W. F. & John Barnes machine which has been rebuilt and re-tooled by Lamb.

Both cast-iron inserts for any one valve are line-machined at one pass.

TWIN COAXIAL TOOLS

One of the tools for this operation is illustrated in Fig. 9. Initial contact with the work is made by four carbide-tipped inserts that plunge-cut the valve seat to a 45-deg. angle. When the seat has been brought to size, the cutter is backed off through a distance of a few thousandths of an inch and a gun-boring tool is fed through a carbide nose bushing. This tool, which has a solid-carbide tip, then finish-bores the valve guide. Both tools are driven at the same time, the outer cutter at 600 r.p.m., and the gun type tool at 3,600 r.p.m.

At another station, special 16-pitch taps are passed through all eight valve guides at one time, to cut spiral oil-grooves. Before leaving this transfer machine, the guide bores are deburred, six intake mounting holes are drilled and tapped, and the cylinder heads are washed with coolant in a 6-station barrel fixture.

During a final machining operation, on a Snyder unit, 0·020 in. is skimmed from the main joint face of the head to ensure correct volume of the combustion chambers. An 8-in. diameter cutter, with 18 inserted carbide teeth, is run at 2,000 ft. per min. with a feed rate of 172 in. per min. A second Centri-Spray installation is provided at the delivery end of this transfer line for a final cleansing operation on the workpieces.

Madan V.H.P. Airhydropump

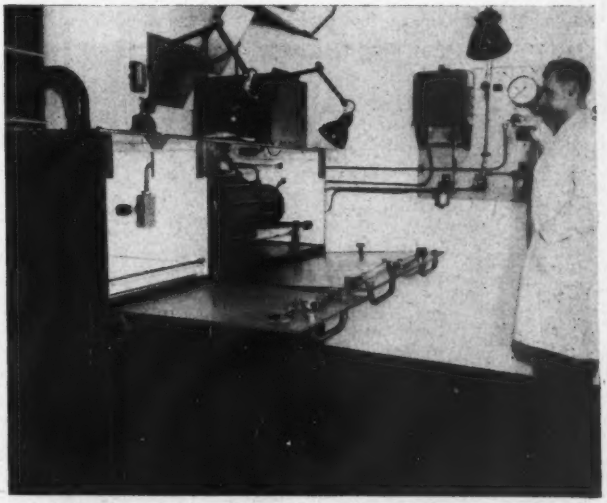
To meet the requirements of industry and research establishments for very high pressures for testing purposes, the range of Airhydropumps made by Charles S. Madan & Co., Ltd., Vortex Works, Broadheath, Altrincham, has been extended by the addition of a V.H.P. type, which will give delivery pressures up to 100,000 lb. per sq. in. from a compressed air supply at 80-100 lb. per sq. in. One of these pumps is seen in the accompanying figure, installed at the maker's works. As will be observed, it is housed in a steel safety cabinet, which has a separate compartment for the unit to be tested, and all controls are mounted externally. The pressure gauge is also protected, and is viewed through mirrors. An interlocking arrangement ensures that the doors cannot be opened while the system is under pressure.

Of the reciprocating type, the pump has an output of about 6 cu. in. per min. at 10,000 lb. per sq. in, which falls to slightly less than 2 cu. in. per min. at 90,000 lb. per sq. in. By means of an air control valve, the pressure may be regulated over the full range from 10,000 to 100,000 lb. per sq. in. If desired, the pressure may be gradually raised by hand.

Alternatively, the air control valve may be adjusted to the value required, and when this pressure is reached the pump will come to rest. Provided there is no leakage from the unit under test, the pump will then remain in a state of balance without any air consumption.

Under overload test, the pump has been operated at a delivery pressure of 132,000 lb. per sq. in.

A range of control valves, pressure release valves, elbows, tees, and couplings has been designed for use with the pump. These items are made from high quality steel, and tested to 120,000 lb. per sq. in.



A Madan V.H.P. Airhydropump for providing pressures up to 100,000 lb. per sq. in. is here seen installed in a steel safety cabinet at the maker's works

East German Machine Tools at the Leipzig Fair

By R. E. GREEN, Associate Editor

Machine tools built by some of the factories of the East German machine tool industry—which number about 50—and shown at this year's Leipzig Spring Fair, were discussed in MACHINERY, 98/939—26/4/61. Grinding machines of new designs, developments of existing machines, and some examples of special-purpose, automatic, equipment are here considered.

OPTICAL PROFILE GRINDING MACHINE

Among several grinding machines exhibited by VEB Mikromat Dresden, Dresden, A 36, Mügelner-Str., 20, was the optical type shown in Fig. 1, which is now made with a projection screen in addition to a microscope. This machine has a capacity for grinding within an area measuring 0·39 in. square without re-setting the work, and within an area of 2·36 by 9·8 in., when the workpiece is moved. Parts of thicknesses up to 1·88 in. can be handled. Grinding wheels of diameters up to 4·9 in. may be fitted, and are driven at speeds up to 3,500 r.p.m. by means of a 0·67-h.p. motor.

The grinding wheel spindle is carried on compound slides which permit swivel adjustment through 180 deg. on each side of the central position of either the upper or lower component, also longitudinal and transverse movements of 5 and 6 in., respectively. For axial relief grinding operations, the wheel carriage can be swivelled through 35 deg., and for lateral relief grinding through 10 deg. on each side of the central position. The slide carrying the wheel is reciprocated through a stroke which is adjustable between 0·39 and 1·96 in., at speeds of 45 or 90 strokes per min., depending on the workpiece thickness.

A work-holding carriage is supported on a column with a vertical adjustment of 3·9 in., and has longitudinal and transverse movements of 9·84 and 2·36 in. Provision is made for setting the carriage by means of gauge blocks when the work is to be moved in relation to the wheel, and dial gauges are also fitted for this purpose. The pantograph table has an area of 19·68 in. square, and the reproduction ratio is 50 : 1. When the machine is fitted with the optical screen, made by VEB Carl Zeiss, Jena, an image of the part is seen at 25 × magnification, and the screen may be covered with transparent material carrying an enlarged drawing of the profile to be ground. With this method, the pantograph mechanism is not employed, the form being followed by manual control of the wheel movements. The field of view of the screen is 0·315 diameter.

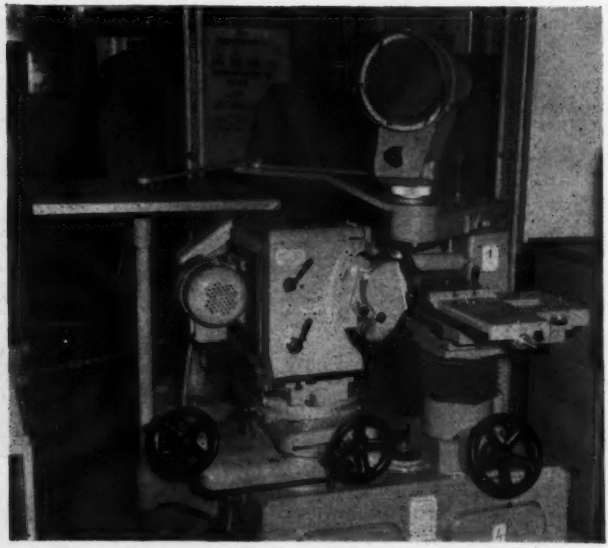


Fig. 1. This type SWPO 50 optical profile grinding machine, made by VEB Mikromat, Dresden, is fitted with a projection screen on which an image of the component, enlarged 25 times, is compared with a drawing of the required profile

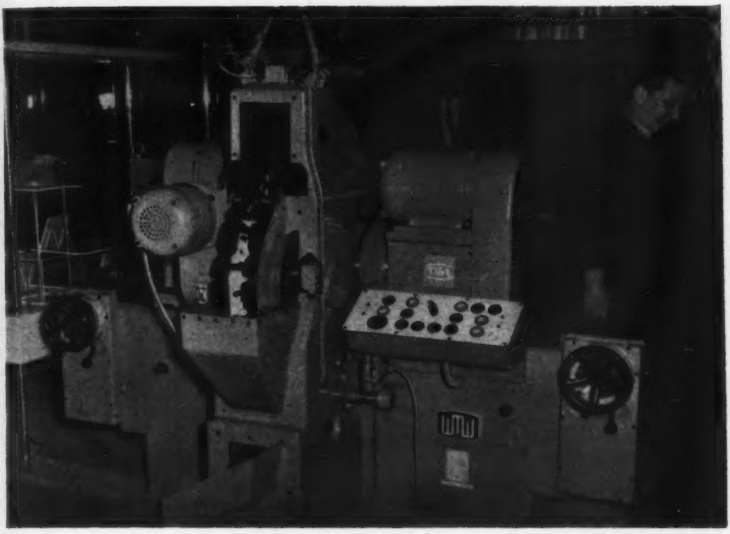


Fig. 2. General view of a drum-type, face-grinding machine built by VEB Mikromat, Dresden, which incorporates standardized wheel-heads from a range made by that factory

DRUM-TYPE FACE-GRINDING MACHINE

On the stand of this factory were also shown two drum-type, face-grinding machines arranged for operations on universal joint spiders and on tappets for motor vehicle engines. The simpler machine—type SFXPW 2-12—for operation on universal joint spiders, was arranged for hand loading, and a general view is shown in Fig. 2. Of conventional construction, the machine has a wheel-head mounted on a slide, which is carried on an extension to the bed, at each side of the central drum. Designated ESS 315, these wheel-heads are the largest in a range of five sizes made by the factory for use in the construction of special-purpose, multi-station, transfer, and other grinding machines.

Each head is fitted with a cup wheel of 11·8 in. diameter, and EK 36 J specification, on a spindle driven by a 4·6-h.p. motor at a speed of 1,600 r.p.m., and can be adjusted on its slide by means of a screw. This screw is turned by a hand-wheel, through gearing, when setting up, and equipment is fitted to the machine for measuring each workpiece and making automatic compensation by feeding the wheel-head whenever wear exceeds a pre-set amount. A close-up view of the central drum, which is also standardised and is fitted with holding fixtures to suit the work, is given in Fig. 3. The drum is driven continuously, at a speed of 0·6 r.p.m., by the small motor at the left, through reduction gearing.

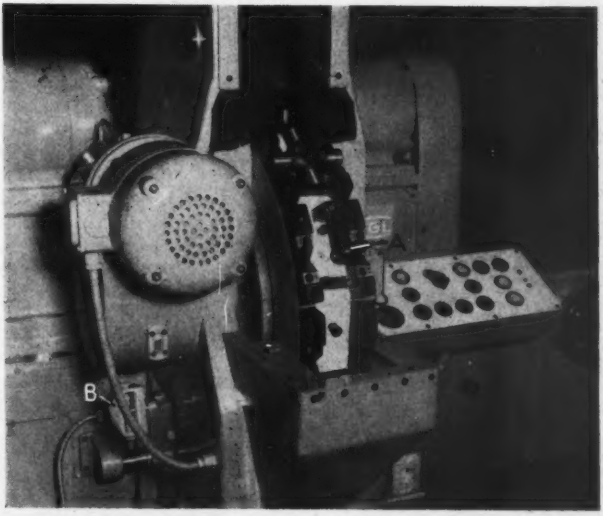


Fig. 3. Close-up view of the work drum for universal joint spiders. At the first loading, the spiders are retained in their V-locations by spring clamps *A*, and are turned before being subsequently loaded into the adjacent fixtures, from which they fall at the lowest point of the drum

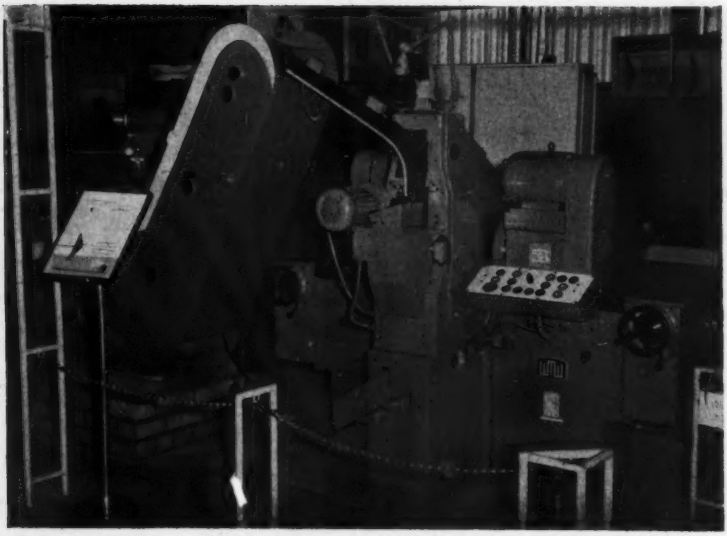


Fig. 4. Rough- and finish-grinding operations on the end faces of tappets are performed on this drum-type machine. Components are fed automatically from the hopper at the left by means of a chain elevator

The periphery of the drum carries 12 holding fixtures for the work, each providing V-locations for three of the spider arms and a pad to support the fourth arm. Alternate fixtures, in which the spiders are initially loaded, are provided with spring retainers, as at *A*, which can be lifted to enable the parts to be placed in the V-locations. The drum turns in an upward direction from the loading position, and the parts are carried between the wheel faces which perform the first grinding operations. As the drum continues to rotate, the spiders return to the loading position, where they are removed and replaced by fresh parts.

Those spiders which have passed once through the machine are then turned through 90 deg. and reloaded at the adjacent fixtures, which have no spring retainers. After passing between the wheels for the second time, the spiders fall out of the fixtures at the lowest point of the drum rotation, and slide down a chute out of the machine. The grinding time per piece, for both operations, is 0·24 min. One of the measuring heads whereby the dimension across the end faces of the spiders is held to 108 $-0{\cdot}040$ $-0{\cdot}075$ mm. (4·2520 $-0{\cdot}0016$ $-0{\cdot}0029$ in) is seen at *B*. These heads were supplied by VEB Feinmesszeugfabrik, Suhl (Thur.), Rimbach-Str., 53.

A dimensional variation of 0·0002 in. is sufficient to close electrical contacts in the measuring head, to complete the circuit to a relay which controls a small motor within a housing at the end of the wheel-head slide, the arrangement being the same at both sides of the machine. The motor runs for a period which provides an amount of infeed of each wheel corresponding to the size of the actuating gap set on the measuring head, up to a maximum of 0·008 in., and then stops automatically.

ROUGH- AND FINISH-GRINDING TAPPETS

The second machine, for rough- and finish-grinding operations on the face of tappets, is shown in the general view in Fig. 4, from which it will be apparent that the layout is the same as that of the machine previously described, except that provision is made for automatic loading and unloading. The tappets, which are mushroom-headed, are approximately 2 in. long overall, with a stem diameter of 0·8 in., and the head is 1·2 in. diameter by 0·19 in. thick. These components are fed to the drum from the hopper at the left in Fig. 4, which is placed at a low level for the convenience of the operator in filling.

By the sloping sides of the hopper, the parts are concentrated above a central slot, too narrow for them to enter. Through the slot project arms which are attached, at intervals, to a continuously-moving, roller-chain conveyor, within the sheet metal casing. These arms move the tappets towards the steeply-sloping face at one side, in which there is a slot sufficiently wide to admit the stems. As the parts are carried upwards, they pass fixed springs at each side of the slot. If the stem of any part has not entered the slot, these springs serve to push it either into the slot, or off the arm so that it returns to the hopper.

At the top of the conveyor, the tappets are discharged into a downward-sloping chute formed by two parallel steel strips, leading to the loading position of the machine, as seen at the upper left in

the close-up view, Fig. 5. As it moves down the chute by gravity, each part operates a micro-switch *C*, and if this switch is held up, due to an accumulation of parts, the circuit to the conveyor driving motor is automatically interrupted. From the sloping portion of the chute, the tappets enter a vertical section down which they travel until each rests with the stem element in contact with the periphery of the drum. As may be seen from Fig. 5, the drum periphery is divided into two portions, separated by a central rib, and has a number of V-shaped grooves, parallel to the axis on which it rotates.

As each of the V-shaped grooves passes the chute outlet, the lowest tappet is moved down into it by the pressure of those above, and it is then carried upwards between the grinding wheels. Only the right-hand, roughing, wheel operates on the head face of the tappet at this loading, and the parts are held in the slots by a band which covers the major part of the drum periphery. After passing the roughing wheel, which removes some 0·006 to 0·008 in. from the face, the tappets are carried past the measuring head, as before, and begin to rise to the loading position once more. A pawl *D*, attached to the lower edge of the loading chute, projects downwards, and ejects the component from the V-groove as it passes.

The ejected tappets roll down the gently-sloping surface in front of the pawl until the left-hand end of each stem is arrested by a small pin. This action causes the tappet to turn about the pin, rolling through an angle of nearly 180 deg., until it reaches a continuation of the sloping surface at a lower level. This face leads down to a position at which the component is again resting in contact with the drum, but turned through 180 deg., and it is then picked up by one of the V-grooves in the left-hand side of the drum periphery. The part now passes the second grinding wheel, which removes about 0·0012 to 0·002 in., and after this finish-grinding stage it is measured and automatically ejected from the drum, to slide down a chute out of the machine at one side. The machine will grind about 800 pieces per hour.

AUTOMATIC CENTRELESS GRINDING MACHINE

For grinding the stem of the tappet, a type SAASL 125 × 200 automatic centreless grinder was shown by VEB Fräs- & Schleifmaschinenwerk Leipzig, W 33, Saarländer-Str., 20. Machines made at this factory, it may be noted, are marketed under the trade name of Mikrosa. A general view of the grinder is given in Fig. 6, and it has a capacity for parts with diameters from 0·078 to 4·9 in. A grinding wheel of 19·68 in. diameter by 7·8 in. face width is mounted on the spindle at the left, which is carried in a rigid housing secured to the machine base, and is driven at a speed of 6,800 or 8,800 ft. per min. The spindle is also arranged to oscillate for the purpose of improving the surface finish on the work.

The regulating wheel, mounted on the slide at the right, has a diameter of 13·78 in., and is driven by a 2-h.p. motor, through helical and spur gears which provide nine speeds from 9 to 91 r.p.m., and a speed of 435 r.p.m. for dressing. Equipment for dressing the grinding wheel is housed beneath the sheet metal cover at the left, and that for the regulating wheel is mounted above the wheel slide. The regulating wheel can be tilted for through-feed grinding, and the machine can also be arranged for automatic plunge-feed operation, with automatic loading, unloading, gauging, and correction equipment, as shown in Fig. 6.

Some details of this equipment may be seen in the close-up view, Fig. 7, and the tappets are fed to the machine by an automatic hopper-conveyor unit similar to that described in connection with the machine in Fig. 4. From the top of this conveyor, the parts enter a chute made from four lengths of steel rod, in which they are initially suspended by the heads. The chute is so designed that as the parts move along under gravity they are turned through 90 deg., to a horizontal posi-

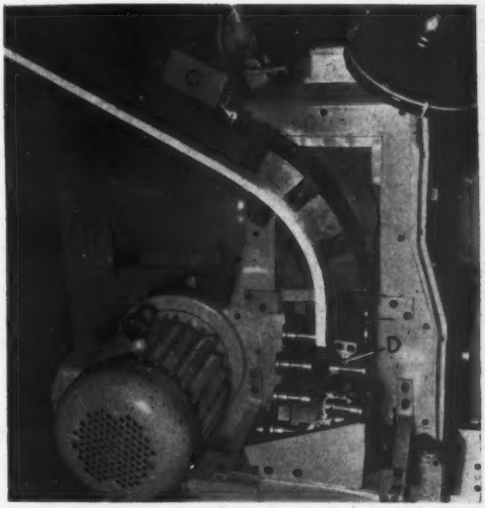


Fig. 5. Tappets fed by the elevator in Fig. 4 travel down a sloping chute to the loading position, and roll into V-grooves in the right-hand side of the drum as the grooves pass the chute outlet

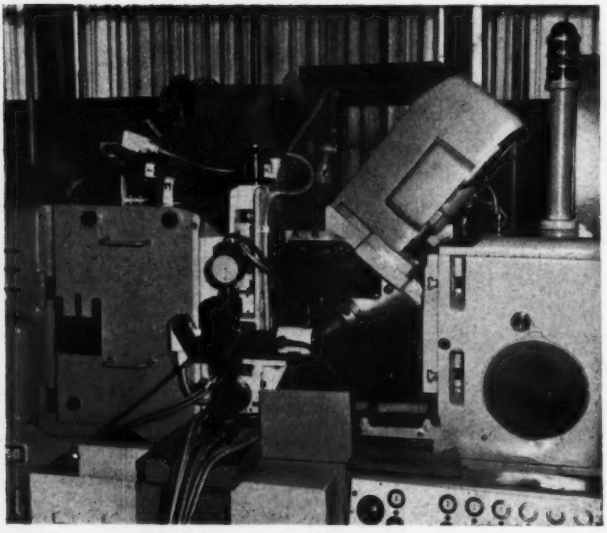


Fig. 6. This standard Mikrosa type SAASL 125 by 200, centreless grinding machine, built by VEB Fräs & Schleifmaschinenwerk, Leipzig, is arranged for automatic loading, stem grinding, unloading, and gauging operations on tappets

tion. From this position, the tappets roll down the remainder of the chute to the entrance to a vertical magazine, operating two micro-switches as they pass. The first of these switches, if held up by an accumulation of parts, stops the driving motor of the conveyor, and the second switch, when released, re-starts this motor to replenish the supply, after an interruption.

The magazine, and all the mechanisms for loading, unloading and gauging, are carried on brackets attached to the regulating wheel slide, so that their positions relative to this slide remain unchanged when it is adjusted to compensate for grinding wheel wear. At the lower end, the column of parts in the magazine is supported by a pin which is retracted by the action of a cam *E*, which operates the lever *F*. The cam *E* is attached to an extension of the ram of the small loading cylinder *G*, and the lever *F* is operated, to release a component, every time the ram of the cylinder returns to the uppermost position.

On the ram extension a cradle is carried, in which the part is deposited as it leaves the magazine, and when the cylinder is actuated for the next loading operation, the supporting pin is returned by a spring and the fresh part is carried down and deposited on the work rest. The part is held in the cradle by a retaining pawl, which is automatically retracted by a stop when the ram reaches the end of its downward travel, and the ram is then retracted, leaving the component on the rest. The regulating wheel is arranged at a slight angle to feed the part towards the rear of the machine, up to a stop formed by the hydraulically-operated ejector rod, to ensure that grinding is carried out over the full length of the stem of the workpiece.

With the part in position on the rest, the regulating slide, which is of compound construc-

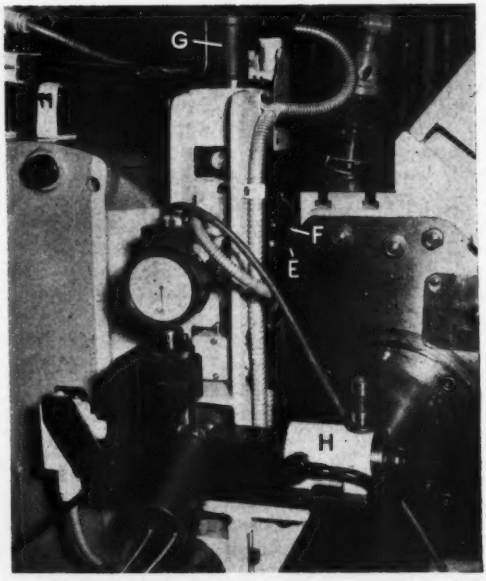


Fig. 7. A close-up view of the automatic gauging equipment fitted to the machine in Fig. 6. When gauging is to take place the ejector rod makes an extra long stroke, and the part is then pushed into the gauging position, against the pressure of a return spring, by the cylinder *H*

Fig. 8. Automatic equipment for the adjustment of the position of the regulating wheel on its slide is operated by the gauging head when an oversize component is detected

tion and moves on roller ways, is fed in by a cam which provides for rapid approach and fine feed movement. After the completion of the grinding cycle, the regulating wheel is retracted and the ejector cylinder is operated to push the finished component out at the front of the machine. The ejector cylinder is set for a stroke slightly longer than the part, so that the latter is pushed clear of the machine, into a cradle. At succeeding cycles, the part is pushed out of this cradle into another wire chute down which it slides into a container at the left.

AUTOMATIC GAUGING EQUIPMENT

The automatic gauging equipment mentioned above is fitted at the side of the cradle through which the component passes as it leaves the machine, and it is brought into operation by means of a counting instrument installed in the electrical control cabinet. This instrument can be set to operate the gauging unit, during the machine cycle, after any number of parts from 1 to 10 has been ground, and for the tappet, it was set to gauge every seventh component. When a component is to be gauged, the ejector cylinder is caused to make a longer stroke than usual, to push the part completely into the cradle and eject the previously-ground part into the chute.

This action moves the part to be measured into line with the ram of the small hydraulic cylinder *H*, at the side of the cradle. The ram of this cylinder is fitted with a pad which enters the groove between the two ground portions of the tappet stem, and pushes it into the gauging station at the left, against the pressure of a spring. Made by VEB Carl Zeiss, Jena, the gauge is of the differential-measuring type, and has electrical contacts which are closed when the part is larger than the pre-set dimension of 20 $\pm$0·003 mm. (0·7874 $\pm$0·00012 in.). A limit switch, fitted at the left-hand side of the gauging station, is also operated when a component is pushed into the gauging position, to complete a circuit, should the contacts of the instrument be closed. The gauge, it may be noted, is also provided with a dial graduated in divisions of 0·001 mm. (0·00004 in.) to afford a visual indication of the diameter measured.

When the contacts of the gauge are closed, a signal is transmitted to the automatic slide adjustment mechanism, which is fitted at the far side of the regulating wheel slide, and is shown in the close-up view, Fig. 8. This mechanism is mounted on the upper of the two slides, which also carries the wheel spindle, and it incorporates a wedge having a taper of 1 in 100. This wedge is arranged to slide between an abutment on the lower slide, and an adjustable projection on the under-side of the upper slide. A hydraulic cylinder on the lower slide applies a load to the upper slide to hold it in contact with the wedge, and the wedge in contact with the abutment.

The wedge is moved at right-angles to the direction of movement of the slide by means of a screw, which is turned through a small angle at each operation of one of two small hydraulic cylinders, the ends of which are seen at *J*. The rams of these cylinders are connected to ratchet mechanisms which turn the screw only when they move in one direction. The second cylinder of the pair is employed when compensation requires to be made for the material removed by dressing the grinding wheel. The number of strokes of the ram of each adjustment cylinder determines the amount of advance of the regulating wheel slide, and this advance can be pre-set in increments of

Fig. 9. A type SWäAKM centreless grinding machine, made by the Mikrosa factory, was arranged for automatic through-feed grinding of tapered bearing rollers at the rate of 4,000 per hour

0·001 mm. (0·00004 in.) up to 0·006 mm. (0·00024 in.), by means of equipment in the electrical control cabinet.

Automatic wheel dressing is also controlled by equipment in the electrical cabinet, and can be carried out after any number of components from 10 to 100 have been ground. When the entire range of adjustment provided by the wedge has been used, the small electric motor *K* is employed to drive the screw in the opposite direction, to wind the wedge back to the starting position. The position of the upper slide relative to the lower slide, and to the abutment mentioned, is then adjusted with the aid of a screw turned by a handwheel. For grinding the tappets, the cycle time is 7·5 sec.

AUTOMATIC CENTRELESS GRINDING MACHINE FOR TAPERED BEARING ROLLERS

Another example of special equipment applied to a standard machine was to be seen on the smaller, type SWäAKM, grinder made by the same factory, a general view of which, arranged for through-feed grinding of tapered bearing rollers, is given in Fig. 9. The machine has a capacity for rollers from 0·236 to 0·98 in. in diameter and up to 1·26 in. long, and is fitted with a grinding wheel of 19·68 in. diameter by 7·87 in. face, driven at a surface speed of 6,800 ft. per min. by a 25-h.p. motor. Instead of the normal regulating wheel, the machine is equipped with a metal wheel having a helical groove, the bottom of which is inclined at twice the taper angle of the rollers to be ground.

This wheel has a diameter and length of 11·8 in., and can be driven at any of nine speeds from 22 to 140 r.p.m., according to the amount of material to be removed from the rollers. Automatic loading and gauging equipment is fitted to this machine also, and permits of grinding rollers at rates up to 4,000 per hour. Rollers to be ground are placed in the hopper at the front of the machine and are lifted by means of a continuously-driven, vertical band conveyor. Shallow cups on this band pick up the individual rollers and raise them to a position from which they roll out into the space

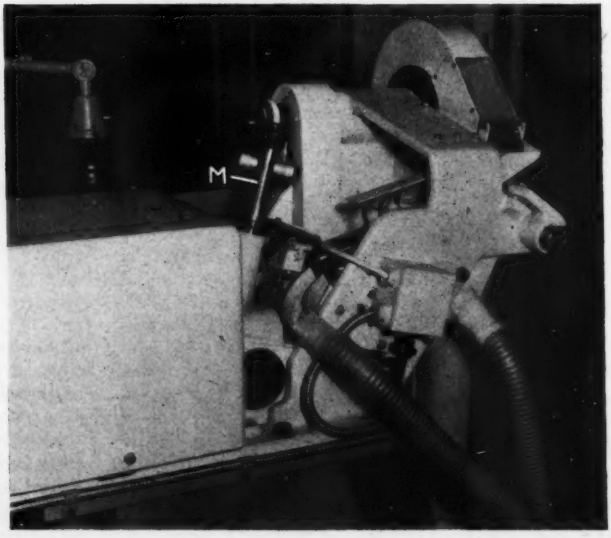


Fig. 10. A vertical elevator on the roller grinding machine raises the parts and releases them on to two rotating tubular shafts which act as gauging units to ensure that only those rollers within specified limits enter the machine

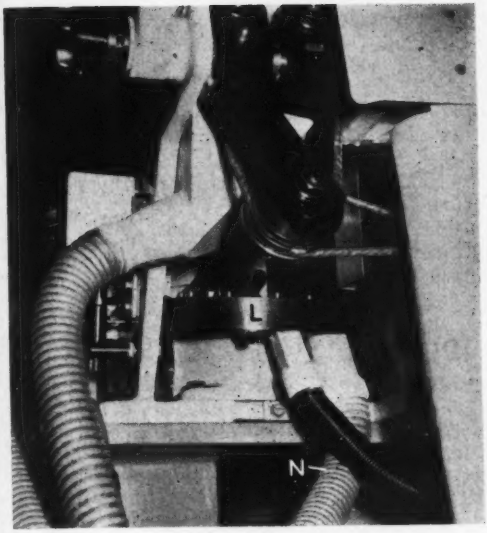


Fig. 11. Rollers which are of the correct diameter are subsequently measured by a comparator for overall length before entering the grinding machine. Parts which are over-length are discharged down the flexible pipe *N*

between two continuously-rotating tubular shafts. These shafts are so spaced that the rollers are suspended between them by their larger ends, and are slightly inclined so that the rollers are carried away from the point of entry.

The tubular shafts are slightly closer together at the point of entry than at the opposite ends, and are just visible in the close-up view from the left-hand side in Fig. 10. Rollers which are too small pass down between the tubes during movement over about the first one-third of their length, and are discharged from the machine through a chute connected to one of the flexible pipes shown. Rollers which are too large are carried along to the ends of the tubes and are discharged into a second chute leading to another flexible pipe. Those rollers which are of the correct size for the grinding operation pass down between the tubular gauging shafts during their passage over the central one-third of their length, and travel down a chute to a position above a rotating drum.

This drum is seen at *L*, in Fig. 11, which is another close-up view from the right-hand side of the mechanism, and it rotates on an almost vertical axis. The upper face of the drum closes the chute opening, and near the edge of this face there is a number of holes of a diameter to accommodate the rollers. As each hole passes the chute outlet, a roller drops into it, and is carried round, past the plunger of a measuring comparator *M*, Fig. 10. This comparator is of similar type to those employed on the drum type grinding machines, and serves to measure the overall length of the rollers.

A roller which is too long operates contacts inside the comparator head and closes a circuit through a solenoid which pushes up a pin in the drum. As the drum turns, the roller is carried past a position at which the lower end of the hole is closed by a shutter. If the pin is raised, it operates a mechanism which momentarily opens the shutter and allows the roller to fall out of the drum, and it then passes down a third flexible pipe *N*, Fig. 11, out of the machine. Rollers which are of the correct length, or shorter, pass over the

Fig. 12. Tapered bearing rollers are carried through the centreless grinding machine by a helically-grooved regulating wheel. A steel strip fitted above the support blade prevents the rollers from being lifted by the edges of the helical groove

closed shutter and leave the drum through an opening above another flexible pipe, the bore of which is sufficiently small to prevent them from being inverted as they travel down.

This pipe leads to a steel tube, which is cut away for part of its length to enable the free passage of the rollers to be observed, and is curved to lead them on to the support blade between the grinding and regulating wheels. The arrangement is shown in Fig. 12, where the helically-grooved regulating wheel is seen at the right. As they approach the support blade, the rollers are held in line by side pieces, and are pushed into the helical groove by the weight of those behind, in the tube. Above the support blade there is a steel strip, adjustable for height, which prevents the rollers from being tilted by the edges of the helical groove as they are carried along at an angle between the wheels. At the far end of the blade, the rollers enter another tube down which they are discharged from the machine.

Other East German machine tools, also machines exhibited by other communist countries at the Leipzig Fair, will be described in future articles.

Expanding Mandrel for Coil Stock

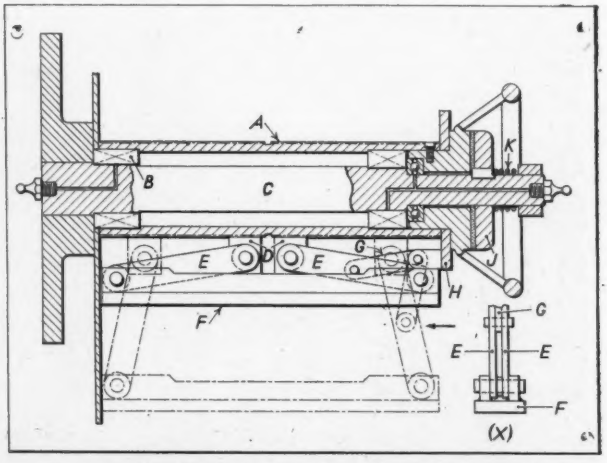
By EMIL LOEFFEL

In the accompanying figure are shown sectional views of an expanding mandrel for holding coil stock, for feeding to a press tool, for example. The design provides for holding coils with bores of different diameters within the approximate range of 2 to 1, and a holder has been made which will support a coil weighing 1 ton. There are three expanding arms, to ensure an effective grip in a bore which is out of round, and a drag brake is incorporated which provides for smooth feed and prevents "over-running".

The steel cylindrical portion *A* incorporates a pair of roller bearings *B*, and it is free to rotate on the shaft *C*. At the left-hand end of this shaft there is a large-diameter flange member whereby the mandrel is secured to a suitable stand. One half of the periphery of the cylinder *A* has a right-hand thread, and the other half a left-hand thread, and the nuts *D* engage with these two threaded portions. Pivoted to the latter there are arms *E*, the outer ends of which, in turn, are pivoted to the member *F*. It will be evident that when the cylinder *A* is turned, by means of the handwheel at the right, the nuts *D* will move towards or away from each other, according to the direction of rotation.

When the nuts move away from each other, for example, the arms *E*, at the extremes of travel, will take up the positions shown by the chain-dotted lines. Each pair of arms *E* has a control link *G*, which is pivoted at one end to a lug projecting from the disc *H*, and at the other, to one of the arms. The purpose of this link is to ensure that the member *F* remains substantially parallel to the centre line of the cylinder *A* in all positions of adjustment. The scrap view at *X* shows the construction of the member *F*, which is weld-fabricated from flat-section steel strips, and the relative positions of the arms *E* and the link *G*.

A braking action is provided by the thrust of the disc *J* against the boss of the handwheel, frictional material being interposed between the two members. Thrust is applied continuously by the spring *K* and can be varied by means of the nut on the end of the shaft *C*. To adjust the mandrel for approximate size, prior to loading a coil, the handwheel is turned while one of the arms is held, to prevent rotation.



This expanding mandrel for coil stock can be adjusted to suit different bore sizes within a diameter range of approximately 2 to 1. Mandrels have been made to support loads of 1 ton

Engineering, Marine, Welding & Nuclear Energy Exhibition—3

Gate Machinery Co., Ltd., 172-178 Victoria Road, London, W.3. Stand No. 2, Row CC, First Floor, Empire Hall

Continental-built machine tools from the range handled by the company in the United Kingdom are being displayed on this stand.

Mention may be made, for instance, of the Italian-built Ribon universal grinder, which has a swing capacity of 11 in., and will admit a maximum length of 20 in. between the work-head and tailstock centres. Traversing speeds of 10, 17, and 27 in. per min. are provided for the table slide, and in-feed can be applied automatically in increments of 0·0002, 0·0004 and 0·0006 in. at the left-hand end of the working stroke. The table can be swivelled through angles up to 5 deg. in each direction, for taper grinding, and the wheel-head can be turned through a maximum of 90 deg. Grinding wheels up to 14 in. diameter by 1 in. wide can be mounted on the spindle, which is driven at a speed of 1,700 or 2,100 r.p.m. by the 2½-h.p. motor. Lubricant is continuously delivered to the phosphor-bronze, spindle bearings by means of a pump.

Driven by a separate 1-h.p. motor, the head for internal grinding can be readily swung downwards to the working position, and can be fitted with spindle units of 2 and 2⅝ in. diameter which can be operated at maximum speeds of 35,000 and 20,000 r.p.m. Bores from ½ to 3 in. diameter can be ground for a maximum depth of 2½ in. with the smaller unit, and from ¾ to 4 in. diameter by 3½ in. deep with the larger size.

Mounted on a swivel base, the work-head is driven by a 0·65-h.p. motor, and 4 work speeds from 100 to 290 r.p.m. are obtainable.

On the Induma (Italian) type 2U universal milling machine which is on view, the 52- by 10⅛-in. work-table has a longitudinal traverse of 33⅜ in., and a cross movement of 10⅝ in., and the vertical travel of the knee is 17¼ in. Twelve feeds from ½ to 19¾ in. per min. are available in each direction, also rapid power traverse at the rate of 67 in. per min. longitudinally and transversely, and 33½ in. per min vertically.

In Fig. 1 is shown the Italian-built Ghiringhelli type A 50 centreless grinder, which will handle work from 0·040 up to 1⅞ in. diameter. It can be fitted with a grinding wheel up to 12 in., and a control wheel up to 8 in. diameter, with a face width of 4 in., and incorporates hydraulically-operated dressing attachments. The grinding wheel spindle is driven at a speed of 1,900 r.p.m. by a 7½-h.p. motor, and 8 speeds from 20 to 60 r.p.m. are available for the control wheel. Alternatively, a hydraulic variable-speed unit can be provided which gives control wheel speeds from 0 to 700 r.p.m.

Centreless grinders in the Ghiringhelli range can be supplied for operation on a semi-automatic cycle, or for fully-automatic working in conjunction with work loading equipment. Provision can be made for oscillation of the grinding wheel spindle over a variable stroke up to ⅞ in., for plunge grinding, and an attachment can be supplied for dressing profile shapes on the wheel.

The display includes the Dutch-made Marco type 15 f.a.w. horizontal bandsawing machine, which is designed for cutting pieces from metal bars, up to 8 in. diameter and 8- by 8-in. cross section, on a fully automatic cycle. A roller table

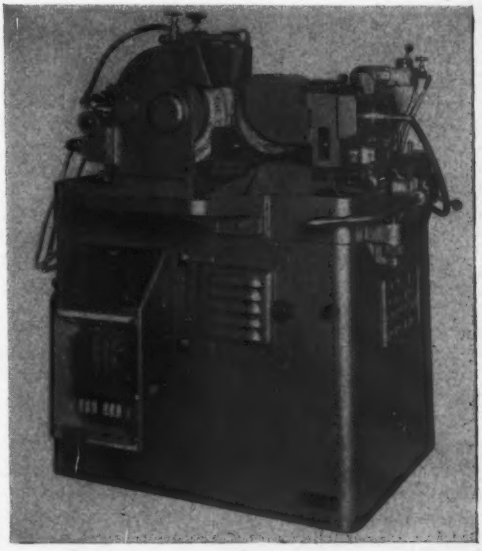


Fig. 1. Italian-built Ghiringhelli type A 50 centreless grinding machine

at one side of the machine carries the bar to be cut, and it is advanced into contact with an end stop at the beginning of each working cycle, by a motor drive. A counter can be fitted which can be pre-set to stop the machine when the required number of pieces has been cut from the bar. If required, the machine can be operated on a manually-controlled cycle, and bars up to 18- by 10-in. cross section and 10 in. diameter can then be cut. The work-holding vice can be swivelled for mitre cutting.

Drive to the 136-in. long by ¾-in. wide bandsaw may be taken from a 1 h.p. motor through a V-belt transmission which provides 4 speeds ranging from 35 to 200 ft. per min., or from a 1½-h.p. motor, through a 9-speed gearbox. With the latter arrangement, speeds from 13 to 262 ft. per min. are obtainable.

In addition, a Brazilian-made Imor type MIN, 15½-in. swing, sliding, surfacing and screwcutting lathe is being exhibited. This lathe is available in various bed lengths to accommodate work from 40 to 160 in., between centres, and was described in MACHINERY, 98/117—18/1/61.

Felco Hoists, Ltd., 29 Cromwell Road, South Kensington, London, S.W.7. Stand No. 7, Row B, Ground Floor, Grand Hall

This company is displaying a comprehensive range of hand and electrically-operated hoisting equipment. The former include hook-suspension type chain blocks, travelling chain blocks, overhead travelling trolleys, Adjust-a-Leg equalizing slings, hydraulic jacks, and hoist runway erectors. Under the latter heading, may be noted electric wire-rope pulley blocks and electric chain blocks. Wedco wire belt slings, Templewood spring-balanced crane forks, and jib cranes are also exhibited.

Cass & Phillip, Ltd., a member company of the Felco Group, are showing their latest-type elapsed-time indicator, which can be fitted to any moving machinery, also road vehicles, to record actual working hours.

Oerliken Electrodes (Great Britain), Ltd., Kelvin Way, Crawley, Sussex. Stand No. 4, Row Z, Empire Hall

Citofil semi-automatic gas-shielded equipment for welding of workpieces in steel, stainless steel, and aluminium and copper and their alloys, is being displayed on this company's stand. The equipment is operated from a 500 amp., constant-potential rectifier, and either CO_2 or argon gas may be used for shielding the weld.

The water-cooled welding gun will take electrodes in the form of continuous wire from 0·04 to 0·10 in. diameter, to which feed is applied by a variable-speed motor. A switch for varying the electrode feed can be mounted on the welding gun or the drive unit, and the latter may be attached to the rectifier if required. There is a single trigger-type switch, which controls the welding current and the electrode feed, and ensures that the gas supply is turned on shortly before welding is actually started, and continues for a short period after welding has been completed.

A type EFS.250 welding set, which is also on view, comprises a single-phase alternator, driven directly by a 3-phase induction motor. Control switches, the starter for the motor, and overload protection equipment, are accommodated in a housing cast in aluminium, and the entire assembly is mounted on a wheeled chassis. Coarse and fine control switches are provided for varying the welding current, and the output frequency is 425 cycles per sec.

C. S. Milne & Co., Ltd., Harley Works, Octavius Street, Deptford, London, S.E.8. Stand No. 2, Row V, Ground Floor, Empire Hall

This company is exhibiting a comprehensive range of equipment for welding, cutting, gouging, de-scaling, and heating, including blowpipes for plastics welding and under-water cutting. Single and two-stage regulators and high pressure valves for welding points and pipe-lines are also shown, together with the Comet flame cutting machine with circle cutting attachment, and the Vic pipe profiling and chamfering machine for preparing pipes and T-branches for welding in a single operation.

Other exhibits include a Creeper straight line and circle-cutting machine; a Vampire heavy-duty flame cutting machine; a joist, channel and beam cutting machine; electric arc and resistance welding accessories; and welders' protective clothing.

A.R.O. Machinery Co., Ltd., 190 Castelnau, London, S.W.13. Stand No. 3, Row V, Ground Floor, Empire Hall

Shown in Fig. 2, is the recently-introduced ARO DP60/150/40P weld press unit which is suitable for series welding or indirect spot or projection welding of mild-steel components. The unit incorporates a water-cooled welding transformer, on the front of which are mounted two small-diameter air cylinders each capable of exerting a force on the electrode ranging from 50 to 330 lb., for an air line pressure of 70 lb. per sq. in. Air supply is controlled by electrically-operated poppet valves which can be supplied as separate units. The assembly may include an adjustable pressure switch. Alternatively, the

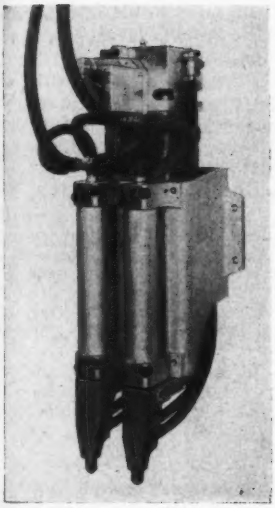


Fig. 2. A.R.O. type DP60/150/40P weld press unit

energizing of the welding transformer can be effected by means of a "squeeze" control built into the timer unit. A number of these units can be mounted side by side, and weld pitches from 1 to 4 in. can be obtained. Sequence controls are available for firing individual units, or banks of units to reduce maximum power demand. If desired, DP60 units can be supplied with air cylinders capable of exerting forces on the electrodes up to 880 lb.

Attention may also be drawn to the type M364 air-operated, pedestal type, spot welding machine, which has 10-in. arms as standard, and provides a secondary welding current in short circuit of 24,000 amp. The electrode force is adjustable up to 1,000 lb., at an air-line pressure of 70 lb. per sq. in., and a range of interchangeable arms up to 30 in. is available. A built-in timer operates on the resistance capacitance principle, and a thermic energy circuit provides weld time compensation when spot welding scaly or slightly rusty mild steel. This machine is suitable, for example, for spot welding aluminium and non-heat-treatable light alloys up to 16 + 16 s.w.g. A type M354 welder of similar capacity, but with foot lever control, is also available.

Another recent addition to the ARO range of welding guns is the type 407, which is designed for high rates of production. When fitted with standard arms giving a working throat of 7 in., it is capable of exerting a force on the electrode of 660 lb., with an air supply at 70 lb. per sq. in. Interchangeable arms are available to provide throat depths up to 31 in. Welding capacity in mild-steel sheet, with 7 in. arms, is 10 + 10 s.w.g. The secondary short circuit current is 14,000 amp., and the transformer and electrodes are water cooled, by the series system. Easy manœuvrability is ensured by a built-in gyroscopic suspension and the use of a spring balance unit from the ARO range. The ARO type CE27 control panel designed for use with this welding gun provides for variable "squeeze," "weld," "forge," and "off" times, and the unit can therefore be used as a "repeat" welder, if desired.

Firth Cleveland Group of Companies, Stornoway House, Cleveland Row, London, S.W.1. Stand No. 35, Outer Row, Gallery, Grand Hall

Firth Cleveland Instruments, Ltd., Treforest, Nr. Pontypridd, Glamorgan, are exhibiting the Gilbarco electronic tank contents gauge and associated remote reading equipment. Other Firth Cleveland control instruments which are on view include flowmeters, a miniature recorder, scaler and totalizer units, a frequency meter, a hopper level switch, conductivity and vibrating probe level controllers, and a variety of pressure switches and pressure relief valves.

Simmonds Aerocessories, Ltd., of the same address, are showing their range of Fram water separators, industrial filters and strainers which are available in a wide range of capacities and designs. There are also Simmonds self-locking nuts, and Spire Speed fastenings.

British Lead Mills, Ltd., are exhibiting pressure moulded lead bricks, as used by the U.K.A.E.A., and a selection of their specialized chemical lead alloys.

British Rototherm Co., Ltd., Station Road, Merton Abbey, London, S.W.19. Stand No. 13, Inner Row, Gallery, Grand Hall

Two additions to their range of mercury-in-steel temperature controllers have been introduced by this company. The first is a 3-stage controller to operate on rise and fall of temperature. It can be arranged, if necessary, to illuminate a warning light, then sound an alarm bell, and finally shut off the plant with which it is employed. It can also be set to give a continuous warning. The controller is available for any range within the limits of −30 and +1,200 deg. F., and comprises a coiled, alloy-steel Bourdon tube, capillary, and temperature sensitive bulb. It operates on a series of mercury switches.

The second new unit is a temperature recorder-controller, which comprises a chart temperature recorder with the addition of hand-set electrical contacts arranged to operate a self-contained, plug-in electronic relay for on/off control. The relay unit incorporates transistorised circuits, and latching is obtained by a positive mechanical action on the main relay, which is of the normal open-contact type.

There is also a new bi-metal, high-temperature thermometer, which is designed for diesel-engine

exhaust gas, and super-heated steam temperature indication. It has a range of 200 to 1,200 deg. F. and comprises a self-compensating and shock-resisting multiple helix, carried in a stainless steel stem. Dials of 2½, 4, and 7-in. diameter are available, and the instruments can be supplied for either horizontal or vertical mounting.

Stewarts & Lloyds, Ltd., Brook House, Upper Brook Street, London, W.1. Stand No. 5, Row E, Grand Hall

The equipment shown in Fig. 3, which is being demonstrated on this stand, is normally employed by the company's Research and Technical Department, at Corby, Northants., for carrying out resonance bending fatigue tests on "welded on" finned tubing for nuclear boilers. Tubing which is tested on this equipment is made by Extended Surface Tube Co., Ltd., who are associates of the company, and Imperial Chemical Industries, Ltd., Millbank, London, S.W.1.

For testing purposes, the tube is supported at two points, and an air pressure of 15 lb. per sq. in. is maintained within the bore. The tube is now vibrated by two weights mounted close to one end, which are oscillated in opposite directions by a d.c. motor drive. The amplitude of the vibrations is maintained at a constant value by adjusting the speed of the motor, and is indicated on a meter built into the control unit. Alternatively, the stress applied to the tube can be measured by means of electric strain gauges. When failure of the tube occurs escape of air from the bore serves to operate a switch incorporated in the pressure gauge on the control unit, to stop the motor and a counter. In practice, a number of tests is carried out on tubes at different stresses, in order to establish a relationship between stress and the number of cycles of vibration required to cause failure. From this information, the fatigue strength of the tubing can be determined.

The display includes examples of seamless steel pipes with bores up to 16 in., for high-pressure gas mains, and the disposal of atomic waste; thick-wall austenitic steel tubing; stainless steel tubing in coil form; extended surface tubing; and butt welded pipes, from the extensive range made by Stewarts & Lloyds, Ltd.

Extended Surface Tube Co., Ltd., are showing examples of welded finned tubing, also Integron finned tubing in stainless and other steels, which is made by a rotary extrusion process.

Fig. 3. This equipment is normally employed by the Research and Technical Department of Stewarts & Lloyds, Ltd., for carrying out resonance bending fatigue tests on finned tubing

Crossley Brothers, Ltd., Openshaw, Manchester, 11. Stand No. 11, Row G, and 12, Row H, Grand Hall

Crossley-Trurnit pointing and cold forming machines for the high-speed production of wood screws, examples of which are being displayed on this stand, are made by the company under licence from Switzerland.

As was described in MACHINERY, 98/783—5/4/61, screw threads are formed on steel blanks during the operating cycles of the forming machines, by the hammering action of dies, which are rotated and simultaneously reciprocated in a radial direction at speeds up to 6,000 strokes per min. A good surface finish is obtained on the threads, and the hammering action results in an increase in the length of the blank of the order of 15 to 20 per cent, so that there is a corresponding saving in the amount of metal required for the production of screws. It is stated, moreover, that an increase in strength of as much as 20 per cent is obtained from the improved grain flow which results from cold working.

At the first stage in the production of a screw, a taper and two or three threads are formed at the end of the blank on a pointing machine. The partly-formed screw is then passed to the cold forming machine, on which the remainder of the thread is produced. Usually two pointing machines are operated in conjunction with three cold forming machines,

since the cycle time for the former operation is shorter than that for the latter. Of patented design, the machines are fitted with hopper feed units for handling blanks and partly-formed components, and have a capacity for producing wood screws in diameters from 0·236 to 0·354 in., and lengths from 2·362 to 5·118 in., which may have deep threads of coarse pitches.

Buma Engineering Co., Ltd., Robson Street, Newcastle-upon-Tyne, 6. Stand No. 23, Outer Row, Gallery, National Hall

The type F.M. fine boring machine for couplings, which was recently introduced, and described in MACHINERY, 98/82—19/4/61, is now also available as the type F.M.2, with a wider range of speeds, namely, 200, 280, 350, 440 and 520 r.p.m. There are two rates of feed, of 0·007 and 0·0035 in. per rev., and the boring capacity is from 2·5 to 6·5-in. diameter by 16-in. deep. Drive is provided by a 1 h.p. motor through multiple V-belts. To ensure accurate boring, the bar is mounted in high-precision combined thrust and needle roller bearings which are housed in steady brackets on either side of the coupling flange.

A special micrometer is supplied with the machine to facilitate accurate setting of the tungsten-carbide cutter, and the latter can be sharpened by means of a built-in, metal-bonded diamond wheel. A taper boring unit can be provided, if required.

Pantak, Ltd., Vale Road, Windsor, Berks. Stand No. 14, Outer Row, Gallery, Grand Hall

This company is exhibiting the full range of Balteau portable X-ray units which they market in this country, also examples from the range of mobile equipment which they produce. The Balteau range comprises two oil-insulated units of 140 and 200 kV., and two gas-insulated units of 150 and 300 kV. capacity. Both the gas insulated units are produced in special forms for 360-deg. radiography, as required, for example, in pipe line examination.

The Pantak range of mobile, oil-insulated units comprises types of 150, 300, and 400 kV. capacity, and it is stated that large numbers have been supplied for use in pressure vessel fabrication. The 400 kV. machine is stated to be the largest of its type produced in this country.

Another exhibit is the Siemens 18 MeV betatron which the company handles in the United Kingdom. This mobile equipment has been developed for use in the examination of steel parts greater than 4 in. thick. A feature of the unit is that it enables a "hot state" radiographic technique to be employed which obviates the need for alternate cooling and heating of the workpiece, and thus eliminates the danger period when flaws may develop. An enlargement technique which can be used with this unit, it is stated, enables very small flaws to be readily detected.

Palmer Aero Products, Ltd., Herga House, Vincent Square, London, S.W.1. Stand No. 11A, Ground Floor, Grand Hall

This company is demonstrating the precision orbital welding method which they have recently developed for automatically joining a pre-formed tube to an end fitting. The technique is intended primarily for use in the aircraft industry, for the fabrication of piping and cable harnesses which may be subjected to high pressures and a considerable range of temperatures. At the same time, vibrations of varying periodicity, arising from the engine structure, necessitate a high degree of strength.

With the orbital welding method, a butt weld is obtained between a fully formed tube held in a fixed position, and an end fitting correctly located in relation to it. The weld crown and penetration bead dimensions can be accurately controlled, and it is stated that 95 per cent of the tube diameter can be maintained without difficulty. The method also has applications in the nuclear power industry, and others concerned with handling corrosive materials at elevated temperatures.

There are also exhibits relating to the company's comprehensive non-destructive testing service which provides for X-ray and gamma ray testing, magnetic and fluorescent crack detection, ultrasonic testing, air and hydraulic pressure testing, and low temperature testing. In addition, film processing and the compilation of radiological reports are undertaken.

John Bull Rubber Co., Ltd., Mechanical Products Division, Evington Valley Mills, Leicester. Stand No. 11, Gallery, Grand Hall

Engineering components in Prescollan polyurethane rubber, shown by the company, are stated to have exceptional resistance to tearing, abrasion, and damage by impact. The harder grades of this material, it is claimed, on account of the high modulus, combine the advantages of rubber and plastics. Some of the components to be shown are illustrated in Fig. 4. They comprise gearwheels, bellows, a conveyor pad, a slideway wiper, and a winding roller. The material is also being used for diaphragms and hammer heads.

In addition, there is a wide range of products in natural and synthetic rubbers, for use in the railway, electrical, chemical, and general engineer-

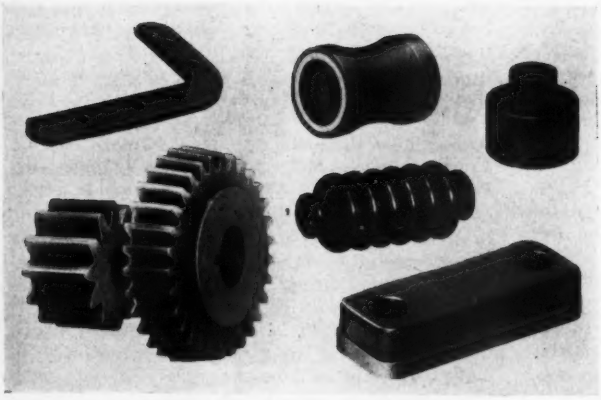


Fig. 4. Examples of products made from Prescollan polyurethane rubber

ing fields, including convoluted and shaped hoses; air-cooling, steam-heating and brake hose; traction motor ventilating bellows; and a variety of mouldings.

H.M.C. Wheels, Ltd., High Street, Hornsey, London, N.8. Stand No. 27, Gallery, Grand Hall

A wide range of wheels and castors for industrial use, which are available from stock, is being exhibited. Wheels of cast iron, with rubber tyres, are made in sizes from 2 to 16 in. diameter, and may have plain, roller, or ball bearings. Wheels without rubber tyres are also available, together with single- and double-flanged types from 2¼ to 12-in. diameter on the tread. Solid rubber wheels up to 9-in. diameter are included in the range, also axle brackets and axles of various sizes.

The castors to be shown include designs for light, medium, and heavy duty, with wheels from 2 to 12-in. diameter. Twin-wheel castors are also made, and various types of fixings are available. In addition, attention is drawn to the H. M. C. range of pressed steel castors and fixed brackets fitted with 3-, 4-, 6-, and 8-in. diameter wheels.

The Plessey Co., Ltd., Vicarage Lane, Ilford, Essex. Stand No. 14, Row BB, First Floor, Empire Hall

Of the various companies in the Plessey Group, Machine Products, Ltd., Kembrey Street, Swindon, Wilts., are exhibiting a comprehensive range of die-pressed sintered-metal components of high and medium density, also sub-assemblies. Parts for switchgear, fuel pumps, shock absorbers, tabulating machines, and domestic equipment are being shown, and there is a special display to draw attention to the various finishes that can be applied to sintered parts.

Power Auxiliaries, Ltd., of the same address, are showing various grades of Plessiflex stainless steel, seamless flexible hose for aircraft, marine, nuclear and general industrial applications.

Exhibits of Hagan Controls, Ltd., 13 Grosvenor Place, London, S.W.1, include a pneumatic boiler control system, ring balance meters, and new, solid-state analogue computer control systems under the name PowrMag. The ring balance meters, as used, for example, for measurement of fluid flow through a pipe or duct, operate by evaluating differential pressure caused by a restriction such as a venturi or an orifice plate that is located in the line of flow.

Henry Beakbane (Fortox), Ltd., Stourport Road, Kidderminster, Worcs. Stand No. 9, Outer Row, Gallery, Grand Hall

New products shown on this stand include telescopic steel covers for protecting the ways of machine tools, and particularly those types on which large amounts of hot swarf are produced. It is possible to stand on these covers, which are designed to withstand hard usage. For short stroke slideways, and for use near tool-posts, there are flexible steel aprons that will resist the action of red-hot swarf.

A new range of P.V.C. and Neoprene moulded bellows and gaiters is also being displayed. These items are made by a new technique that is economic for quantities of two dozen or more. It is stated that tooling costs for this method are very low so that small quantities of components to special designs can be produced economically.

The standard range of fabricated corrugated covers is to be produced, in future, with an aluminium finish, and examples are on view.

Lincoln Electric Co., Ltd., Welwyn Garden City, Herts. Stand No. 4, Row U, Empire Hall

Several recent additions to the company's range of CO_2 gas-shielded and submerged-arc welding equipment, are being exhibited. Prominence is given to the new Lincoln Sprite equipment for hand welding sheet metal components with thicknesses down to 20 s.w.g., in the motor-car industry for example, by the CO_2 gas-shielded process. The welding gun is connected to the electrode feed unit by a single light-weight cable, which has been designed to take the electrode wire, also the gas

and power supplies. Spearate micro-switches are built into the hand-piece for the welding gun, which enable the electrode to be "inched" in either direction as may be required at the beginning and end of a welding operation. Electrode wire of $\frac{1}{32}$ and $\frac{3}{64}$ in. diameter can be employed with the equipment, and steplessly-variable feeds from 130 to 300 in. per min. are provided by a d.c. motor drive. A type CV. 400 motor generator supplies the d.c. motor, and provides the welding current, which can be varied from 60 to 200 amp. by a knob on a separate remote control unit.

The recently-introduced Lincoln-Cloos type CA3 equipment enables conventional semi-automatic hand welding by the CO_2 shielded-arc process, also spot, plug and tack welding, to be carried out with the same gun. Electrode wire is fed to the water-cooled nozzle in the welding gun through a flexible cable, by means of rolls for which a variable-speed drive is provided. As may be seen in Fig. 5, the control unit, electrode feed mechanism, and cooling system for the nozzle, are mounted on a wheeled framework, which will take two cylinders for CO_2 gas. Provision is made for connecting a separate remote control unit to the CA3 welding equipment, if required.

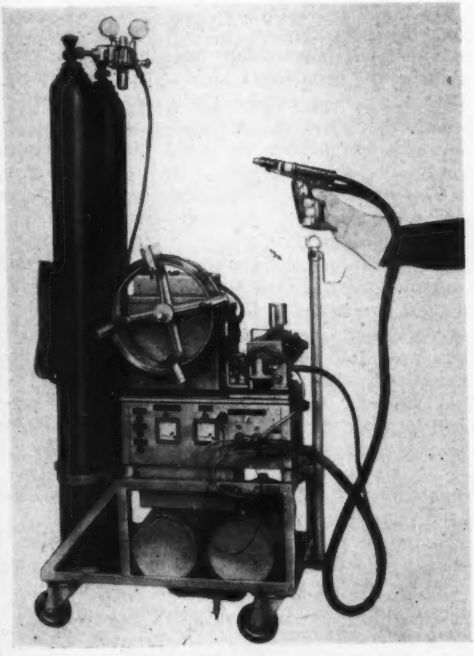


Fig. 5. Lincoln-Cloos type CA3 semi-automatic gas-shielded arc welding equipment

A type B.30 fully-automatic CO_2 welding head has been developed from the company's equipment for submerged-arc welding. It is fitted with a water-cooled nozzle, and feeds for the small-diameter electrode wire can be varied from 85·3 to 686·6 in. per min.

Another exhibit is a type D.15 fully-automatic head, which is intended to be mounted on a travelling boom for longitudinal and circumferential submerged-arc welding operations within the bores of pipes down to 14 in. diameter. Type M.L.3 equipment for manual submerged-arc welding, mounted on a type L.L.C. column and boom assembly, is being demonstrated in conjunction with a Lincoln SAE 600 motor generator, for which remote control is provided.

A selection from the company's range of welding positioners, generators, transformers, and rectifiers, also Arcair cutting and gouging equipment, are also being displayed.

Siemens-Schuckert (Great Britain), Ltd., Faraday Works, Great West Road, Brentford, Middlesex. Stand No. 4, Row Y, Empire Hall

A representative selection of the company's new series RPA air-operated spot welders is being shown. Transformers with ratings from 7 to 100 kVA., at 50 per cent duty cycle, are employed which conform to B.S. 3065/1959. Arm lengths range from 12 to 36 in., and cylinder diameters from 3 to 6 in., each air cylinder and integral valve assembly being designed for high speed operation with fully-cushioned weld and return strokes. Two-, three- and four-stage self-contained electronic timers with plug-in connections cover most operating sequences, but high-speed contactor or ignitron control can be provided, if required.

There are also examples of the WP range of pedal-operated spot welders, which are made with ratings from one to 50 kVA. The smaller sizes of these machines have air-cooled transformers, and for the larger sizes, water cooling is provided for both the transformers and electrodes. Arm lengths range from 3 to 30 in., and electronic weld timers are normally fitted. Synchronous timers can be supplied to suit particular requirements.

One of the new range of R.S.A. air-operated seam welding machines is being demonstrated, fitted with the optional intermittent drive attachment. These machines are available in a range of transformer ratings conforming to B.S. 3065/1959, and both circumferential and longitudinal seam welding can be performed.

The intermittent drive attachment, which is the subject of a patent application, has been developed for operations on components which are required

to be joined with a series of spots which are more widely spaced than is normal with seam welding. An electronically-controlled clutch is fitted between the drive motor and the electrode wheels, and the weld is performed with the wheels stationary. The wheels are then run at a fast rate to move the material to the next welding position, and in this manner an overall speed of 20 ft. per min. is obtained at 2-in. spacing, 25 ft. per min. at 3-in. spacing, and 36 ft. per min. at 6-in. spacing. An ignitron contactor, together with the electronic controls, is housed in the machine frame. The machine may also be used for normal seam welding by fitting a suitable control panel. It is stated that this system of intermittent operation can readily be applied to any seam welding machine made by the company.

Weldcraft, Ltd., Windsor Works, Slough, Bucks. Stand No. 2, Row Z, Empire Hall

A new range of metal joining alloys has been introduced by this company, under the name Obvis. These alloys, the use of which is being demonstrated, have the advantage of low heat requirements in application, but are claimed to provide strength equivalent to that obtainable by fusion welding. The bond is achieved by the formation of a surface alloy between the parent metal and the deposit. There is no fusion of the base metal, and comparatively little heat is therefore transferred to the areas surrounding the joint.

Other exhibits on this stand include a complete range of electrodes for welding mild, high-tensile, and stainless steels, cast iron, and non-ferrous alloys, also for hard-facing applications. Arc welding machines and accessories are being shown, and among gas welding equipment on show may be mentioned blowpipes, regulators and accessories, and welding rods. Reference may also be made to the Aut-O-Cet and "sight feed" acetylene generators, and to demonstrations of the Gasflux welding process.

Holden & Hunt, Ltd., Cox's Lane Works, Old Hill, Staffs. Stand No. 4, Row X, Empire Hall

Various types of resistance welding and heating machines from the company's range are being shown, many of which are available for demonstration. A total of 21 machines on view includes nine spot welders with ratings from 5 to 50 kVA., five of which are of the pedal-operated type, and the remainder designed for operation by compressed air. These machines incorporate different arrangements for controlling the welding period, also various types of electrodes and arms. A 15 kVA. air-operated rocker-arm type spot welder is illustrated in Fig. 6.

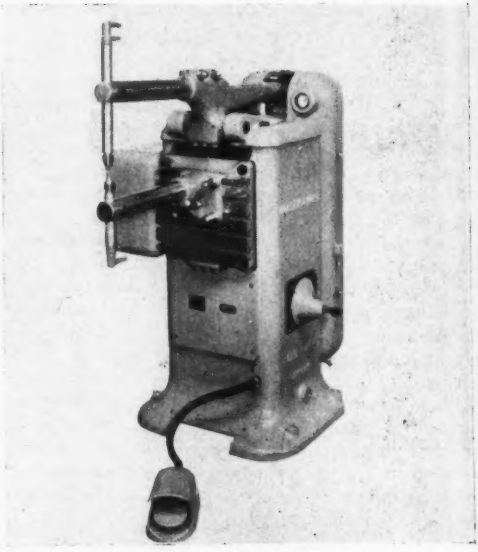


Fig. 6. Holden & Hunt 15-kVA. air-operated, rocker-arm type, spot-welding machine

Press-type spot welding machines in the range made by the company, which are represented by a 50 kVA. machine, can be readily converted for projection welding if required. Five automatic wire butt-welding machines are being shown, which will handle mild steel wires and bars from 20 s.w.g. up to ½ in. diameter, and have hand-, foot-, or air-operated work clamping arrangements. One of these machines, of the firm's latest design, has a fabricated steel frame, and incorporates a built-in grinding unit. A No. 4 flash butt-welder, on view, is the smallest size in the company's range, which covers six machines. In addition, there are rivet heating machines, fitted with single, double, and triple electrode heads, with capacities for heating rivets from ¼ in. diameter by ½ in. long, up to 1⅛ in. diameter by 6 in. long, also a No. 0 machine for trimming the ends of wires and welded wire assemblies.

Blackhawk, Ltd., 12-16 Brunel Road, London, W.3. Stand No. 18, Gallery, National Hall

Hydraulic pumps and rams, also examples of attachments from the company's Porto-Power range, are being displayed. The rams are available in capacities from 2 to 60 tons, and may be fitted with attachments for toe lifting, pressing, pipe bending, wheel and bearing pulling, and other operations concerned with maintenance work.

A recently-introduced air-hydraulic pump is

designed for operation from a shop compressed air supply, and will deliver fluid at 10,000 lb. per sq. in. pressure, for operating a ram of 10 tons capacity. It weighs only 8¾ lb., and is arranged for foot control. In addition, there is a new type P.556, wobble-plate, 4-piston pump, which is driven by a 1-h.p. motor. This pump will deliver 100 cu. in. of oil per min. at 150 lb. per sq. in. pressure, or 50 cu. in. per min. at 10,000 lb. per sq. in. pressure. Mention may also be made of a type S.362, 20-ton capacity, hydraulic press, and a bending machine for pipes from ⅜ to 4 in. bore, which have recently been added to the Porto-Power range. The Blackhawk range of hydraulic jacks has recently been the subject of some design improvements, and three new sizes have been introduced, which have capacities of 30, 50 and 100 tons. The smallest jack in the range has a rating of 1½ tons.

Part of the stand has been designed to indicate the facilities afforded by the Power-Packer Division, which has recently been formed by the company to assist customer firms in the design and development of hydraulic equipment for their products. The Division is exhibiting two new hand-operated hydraulic pumps, also two motor-driven pumps which can be operated from 6- and 12-volt batteries. Pumps of both types can be supplied for delivering fluid at a pressure of 2,500 or 5,000 lb. per sq. in.

The Glacier Metal Co., Ltd., 368 Ealing Road, Alperton, Middlesex. Stand No. 38, Gallery, Grand Hall

Plain bearings for all industries are shown on this stand, including heavy marine and industrial plant bearings, lined and machined at the company's service stations. For turbines and other high-speed rotating machinery there are anti-whirl bearings, and thin- and thick-walled engine bearings and bushes include steel-backed white-metal or copper-lead lined types, with or without lead-tin overlay plating.

Micro-clearance and film-located bearings are specially intended for engineering applications, for example on machine tools, where accurate shaft location and a high degree of rigidity are essential.

Reference may also be made to the Glacier DU DQ, DG, and DL dry bearing materials and surface treatments which obviate the need for lubrication, and to Glacier, high-strength, reticular-tin aluminium material for bearings, bushes and thrust washers. Standard products, comprising wrapped and bronze bushes, fully-machined bronze and phosphor-bronze bars, and ingot white-metal are also on view, together with tin-base, lead-base, aluminium, zinc, and brass die castings.

The Addison Tool Co., Ltd., Addison House, 28 Marshalsea Road, London, S.E.1. Stand No. 13, Row K, Grand Hall

Exhibits on this stand include the French-built Winter 250S/A semi-automatic, air-operated circular sawing machine shown in Fig. 7, for which the company is sole agent in this country. It has a capacity for round bars or tubes up to 2·15 in. diameter, and for square bars, up to 2·75 in. The spindle, which mounts a 9·8-in. or 11·8-in. diameter saw, runs in Timken taper-roller bearings, and four speeds are obtainable by means of stepped V-belt pulleys. Speeds for cutting ferrous materials range from 30 to 68 r.p.m., but higher speeds, from 510 to 1,120 r.p.m. can be provided for cutting non-ferrous metals and plastics. Drive is taken from a 1½-h.p. motor on the slow speed machine. Swivel adjustment is provided for the air-operated vice which clamps the work on both sides of the saw, to enable angle cutting to be performed. If required, a T-slotted table can be fitted instead of a vice, and coolant equipment is provided.

A hand-operated cutting-off machine made by Jungbluth KG. Maschinenfabrik, Bad Godesberg, Germany, who are represented by the company in this country, is also being shown. On this machine,

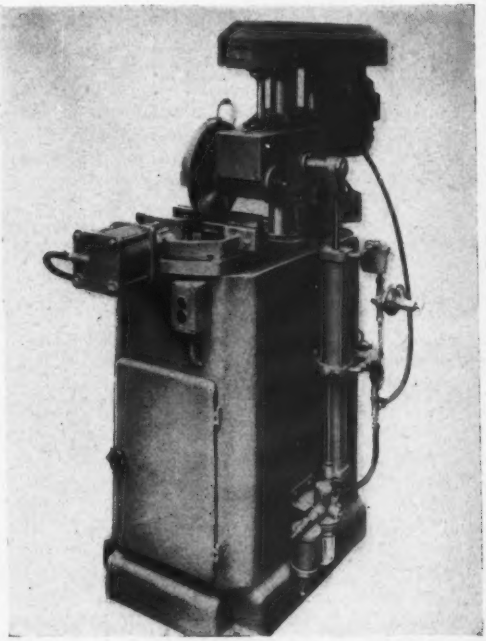


Fig. 7. Winter type 250S/A semi-automatic circular sawing machine

cutting is performed by means of a 20½-in. diameter steel friction disc, which can be resharpened. The drive is provided by a motor of 10 h.p., and the cutting head moves on anti-friction bearings.

Mention may also be made of the Mediolanum automatic tube bender built by A. Crippa, Arosio, Italy. The machine is electro-hydraulically operated and clamping and mandrel retraction are performed automatically. Tubes up to 1⅝ in. diameter by 12 s.w.g. can be bent, and the mandrel is 13 ft. long. The angle of bend is controlled by an Addomatic electronic selector and easily-prepared punched cards. With the standard unit, up to ten bends, to five different angles, can be made.

Bristol Siddeley Engines, Ltd., P.O. Box No. 3, Filton, Bristol. Stand No. 6 and 7, Row P, Ground Floor, National Hall

This company's exhibits include examples of re-circulating ball screws and splines which are made in co-operation with the Beaver Precision Products Inc., Detroit, U.S.A. Shaft lengths for ball screws may range from 6 in. to 30 ft., and they can be supplied for operation under loads up to 160,000 lb., or 825,000 lb. for static conditions. It is stated that the screws, which are made to a lead accuracy of 0·0002 in. per ft., and can be supplied in pre-loaded form, will operate efficiently at temperatures from −55 deg. C. to more than 450 deg. C. An efficiency exceeding 90 per cent is claimed, and among numerous applications may be mentioned ladle tilting mechanisms in steel works, actuators for flying controls in aircraft, power steering mechanisms for road vehicles, steering gear for ships, and railway track switch actuators.

In addition, ball splines incorporating recirculating balls are on view. If required, these units can be supplied with angular pre-loading, multiple circuits, and telescopic extensions.

Twiflex Couplings, Ltd., The Green, Twickenham, Middlesex. Stand No. 2, Outer Row, Gallery, Grand Hall

This company—one of the Sheepbridge Engineering Group—is showing the recently-developed Twiflex-Hilliard intermittent drive unit which is illustrated in Fig. 8. This unit incorporates a single-revolution clutch with a single-point trip cam which automatically gives 360 deg. rotation between stops. Alternatively, a multiple-point trip cam can be provided to give a maximum of eight stops per rev. Drive is initiated through a solenoid, and the non-repeat trip mechanism ensures that only the required rotation takes place however long the solenoid control is held in the engaged position. The non-repeat mechanism can

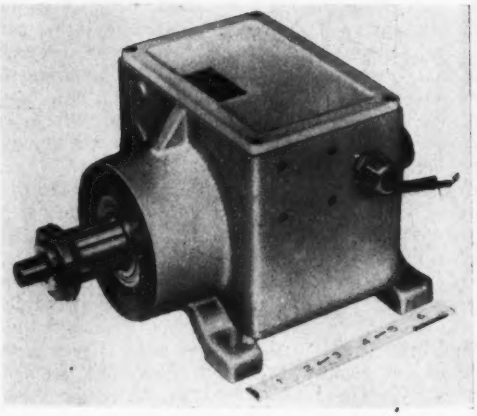


Fig. 8. Twiflex-Hilliard intermittent drive unit

be disengaged should the output shaft be required to make more than one revolution. An adjustable brake is fitted to ensure correct stopping of the output shaft, and, if required, a positive stop can be provided, also a mechanism to prevent the driven equipment from over-running.

As a general guide, the unit can be operated at speeds from 40 to 400 r.p.m., but higher and lower speeds may be possible in some circumstances. Maximum operating frequency is approximately 350 cycles per min. In Fig. 8, the input sleeve is seen on the left. It is 1½-in. diameter and is provided with a keyway and clamping nut. Projecting from it is an ⅜-in. diameter extension of the output shaft, which can be employed, for example, for mounting a counter or sequence switch. If required, a lever can be provided, for mechanical control of the unit.

Another exhibit is a unit which demonstrates the application of Twiflex automatic clutch couplings for freeing engines and electric motors of load when starting. Twiflex flexible couplings, and the Twiflex hydraulically-operated industrial disc brakes, developed in collaboration with the Dunlop Rubber Co., Ltd., are also on view.

Murex Welding Processes, Ltd., Waltham Cross, Herts. Stand No. 2, Row W, Empire Hall

The Muramatic automatic arc welding head, which is being demonstrated on this company's stand, may be mounted on various types of booms, columns and mobile platforms. It is designed for operation from a.c. or d.c. supplies at currents up to 1,200 amp., and enables welding to be carried out by the open-arc or submerged-arc processes.

For deck welding duties, either one or two Muramatic heads may be mounted on a carriage, which can be steered or traversed on guide rails at speeds ranging from 8 to 40 in. per min. A fillet welder on view comprises two Muramatic heads mounted on a self-propelled carriage, and enables horizontal-vertical fillet welds to be made on both sides of a stiffening piece, simultaneously.

Various types of electrodes and fluxes for welding mild steel and stainless steels are being shown. In addition to the well-established Fortrex electrodes, which are being extensively employed for welding operations in connection with nuclear reactors, special mention may be made of Suprex and Nicrex electrodes for welding, respectively, creep-resisting and stainless steels. Ironex iron powder electrodes are stated to enable high rates of deposition to be obtained, and the Fastrex 100 electrodes are intended particularly for such operations as pipeline welding, and down-hand welding of large vessels.

The display includes welding transformers, also generators with electric motor and petrol- and diesel-engine drives.

Atlas Copco (Great Britain), Ltd., Maylands Avenue, Hemel Hempstead, Herts. Stand No. 4, Row R, Grand Hall

Exhibits on this stand include the new type DT4 short-stroke double-acting stationary air compressor. This compressor is air cooled and delivers 565 cu. ft. of air per min. at a pressure of 100 lb. per sq. in., when driven at 970 r.p.m., by a motor of 120 h.p. There is also a type TT6 2-stage, single-acting compressor unit with intercooler, which has a delivery capacity of 140 cu. ft. of air per min. at a pressure of 100 lb. per sq. in. The type KE6RAS compressor, intended for use in small engineering workshops, has a piston displacement of 46·3 cu. ft. of air per min., and a maximum operating pressure of 100 lb. per sq. in.

Among a comprehensive selection of engineers' pneumatic tools may be mentioned those in the new Delta range which are of low weight, small dimensions, and high power. For example, the drills weigh less than 3 lb., and each is driven by a new type of 5-vane air motor which develops nearly 0·5 h.p. Three types of drill are at present available, with free speeds of 1,300 or 2,600 r.p.m., and drilling capacities of 0·25 or 0·4 in., and the range is to be increased to include screw and nut runners, and grinders.

Air-operated screwdrivers, impact wrenches, grinders, chipping hammers, screw-feed drills, aircraft riveters, sand rammers, hoists, and a rotary filing machine, are also being shown. Among the impact wrenches, the LM 525, of ⅝-in. capacity, has an air motor which is 30 per cent more powerful than that of the earlier type LM523. With an air line pressure of 85 lb. per sq. in., when operating on ⅝-in. diameter bolts, the tool delivers 215 ft.-lb. in 3 sec., which provides for a bolt tension of 26,400 lb.

E.N.V. Engineering Co., Ltd., Hythe Road, Willesden, London, N.W.10. Stand No. 15, Row D, Grand Hall

On this stand there are examples of gear drives for industrial, marine, and railway applications. At the company's large and well equipped works, plant is installed for cutting spiral bevel gears, for instance, up to 72 in. diameter. Fig. 9 is a close-up view of a Gleason No. 70 machine set up at the E.N.V. works for cutting a 55·3-in. diameter spiral bevel gear of 0·89 d.p. for a rolling mill drive.

Various sizes of spur and helical gears, also straight-tooth bevel, spiral, and hypoid gears, for industrial applications, are being shown. One pair of hypoid gears on view, which is believed to be the largest yet produced in this country, has a

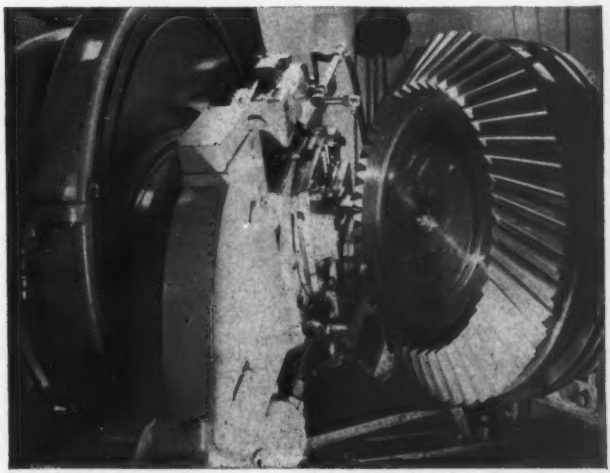


Fig. 9. Close-up view of a Gleason No. 70 machine set up at the works of E.N.V. Engineering Co., Ltd., for cutting a 55·3-in. diameter, 9-in. face width, spiral bevel gear of 0·89 d.p., for a rolling mill drive

6-in. off-set, and the diameter of the crown wheel is 40 in. Particular attention may be drawn to a selection of spiral bevel gears which have precision ground teeth. Equipment for industrial trucks, which is being exhibited, includes double-reduction axles, and carrier assemblies for differential gears. A newly-designed double-reduction differential carrier, which is designated type D.R. 129, can be supplied to give reduction ratios up to 19 to 1, and for transmitting a maximum of 5,000 lb.-ft. torque.

There is a hypoid axle-mounted drive unit, and spiral bevel gears for railway propulsion duties, also spiral bevel gears with precision ground teeth for a gas turbine locomotive. Reference may also be made to spiral bevel gears—again, with ground teeth—which are intended for use with marine engines up to 4,000 h.p. to transmit high-speed drives between shafts disposed at small angles. In addition, the well-established E.N.V. bevel gear drive for marine duties is on view. This drive is designed for operation in conjunction with engines up to 100 h.p. for transmission between a pair of shafts set at an angle of 16 deg.

Smiths Industrial Division, Chronos Works, North Circular Road, London, N.W.2. Stand No. 3, Row Z, Empire Hall

Ultrasonic flaw detecting equipment exhibited on this stand includes the Kelvin Hughes Mark 6 and Mark 5F instruments, and the Immerscope type 424-A unit, which is made by the company under a reciprocal agreement with the Curtiss Wright Corporation, U.S.A.

The Mark 6 equipment enables inspection to be carried out by contact, gap, and immersion scanning techniques, and is operated in conjunction with barium titanate probes which may have single, twin, or separate transmitting heads. Monitoring circuits can be incorporated which enable inspection to be carried out on a semi-automatic basis, and provision can be made for recording, photographically, the trace on the 5-in. cathode ray tube. The equipment incorporates separate indicator and control units, which are mounted on a wheeled base as shown in Fig. 10, and can be swivelled as a single assembly in the horizontal and vertical planes for setting in a convenient position for operation, and for viewing the cathode ray tube. With the Kelvin Hughes 2-channel flaw alarm unit, which is being demonstrated in conjunction with the Mark 6 equipment, two separate areas of the work can be examined independently, and the presence of flaws is automatically indicated by either audible or visual signals.

The Mark 5F ultrasonic flaw detecting equipment, which is being demonstrated in conjunction with the Kelvin Hughes Mark 3 depth and thickness gauge, has a 3-in. cathode ray tube, and five different operating frequencies, from ¾ to 5 megacycles per sec., are obtainable. The instrument can be set by means of a 10-position switch for checking mild steel plates from 2 in. up to 12 ft. thick, and provision can be made, if required, for inspecting work up to 25 ft. thick.

Fig. 10. Kelvin Hughes Mark 6 ultrasonic flaw detecting equipment

The Gas Council, 1 Grosvenor Place, London, S.W.1. Stand No. 5, Row N, Grand Hall

Particular attention is drawn to the part played by the gas industry in the automation of industrial heating processes. There is, for example, a brass billet heating furnace designed by the South Western Gas Board and built by Industrial Furnaces, Ltd. This furnace will handle billets up to 2 in. diameter by 3 in. long for hot brass pressing. It is of vertical design, with a Syntron feeder, and can be set to discharge heated billets automatically, at a predetermined rate, or singly under the control of a push-button.

Another exhibit is a prototype of a flash melting equipment which provides a new method of melting non-ferrous metals, rapidly and economically. Designed by the North Eastern Gas Board, this equipment has a melting capacity of about 100 lb. per charge and is arranged for load recuperation in addition to combustion air pre-heating. Normally, the charge remains in the load recuperation

section for a period of 8 to 10 min., while the previous 100 lb. charge is being melted. It is stated that the metal cast is of good quality, and that metal losses, also fuel consumption, are low. Under normal conditions, the combustion air is preheated to a temperature in excess of 300 deg. C.

Mention may also be made of the Peddinghaus patented spin hardening method which is applied in gas-heated gear hardening machines handled by Surfard, Ltd., Alford House, 15, Wilton Road, London, S.W.1. These machines, one of which is demonstrated, are available to treat components ranging from small pinions up to gears of 5 ft. diameter by 10 in. face width. The complete cycle of operations is pre-set, and the temperature is automatically controlled. As an example of the production capabilities, it is stated that the floor-to-floor time for surface hardening a gear of 8¾ in. diameter by 4 in. face width is 3½ min.

The Midlands Research Station of the Gas Council has developed a system of automatic control which enables a high-velocity air-blast tunnel burner to be ignited by means of a sparking plug positioned approximately in the air-gas stream. In addition, the presence or absence of a flame in the tunnel may be detected by means of an infra-red sensitive viewing head. Elcontrol, Ltd., Wilbury Way, Hitchin, Herts., supply two types of control, namely, the FSTI for semi-automatic, and the FST2 for fully-automatic ignition. Both controls are used with a standard VH101P infra-red viewing head.

An example is also shown of a range of complete recirculation-type direct-fired heaters and fans which are intended for application to ovens or other process air heating equipment to provide high circulating volumes and low temperature differentials. The maximum temperature for the air leaving the heater is normally 600 deg. F., but higher temperatures can be obtained with little modification. In addition, there is a new design of package conversion burner for central heating boilers, process air heaters, and other industrial applications.

Dallow Lambert & Co., Ltd., Thurmaston, Leicester. Stand No. 3, Row BB, First Floor, Empire Hall

Dust collecting equipment made by this company is extensively employed in a wide variety of industries, and examples from their range are being displayed, including an MG30 type A wet deduster unit, which is available in 13 sizes with capacities for handling from 2,000 up to 48,000 cu. ft. of air per min. Four different arrangements for removing sludge can be provided for this equipment.

Five units from the firm's Unimaster range are also on view, two of which, designated UM50V and UM100V, are particularly intended for dust control duties in connection with pneumatic conveyors. The Unimaster UM102 dust control unit which is displayed, has been fitted with glass panels so that the internal arrangement can be examined. In addition, there is a Unimaster UM100 unit, fitted with a special attachment for dust control in connection with sack tipping operations, and a Unimaster UM254 dust control unit with provision for automatic filter shaking. The last-mentioned unit is the largest in the company's range, and the fan will handle 2,200 cu. ft. per min. at 2·5 in. water gauge.

Unimaster dust collecting units, which were described in MACHINERY, 96/1114—18/5/60, occupy comparatively little floor space, and incorporate fabric filters of improved patented design. Filters made from different fabrics can be supplied to suit the type of dust to be handled, and the cleaning mechanism is driven by an electric motor. In Fig. 11 is shown one of the units from the Unimaster range connected to a Dallow Lambert Mark 2 dust collecting hood, and arranged for operation in conjunction with a polishing machine

Fig. 11. A Dallow Lambert Unimaster dust collecting unit and Mark 2 hood arranged for operation in conjunction with a polishing machine [*by courtesy of Precision Metal Spinnings (Stratford-on-Avon), Ltd.*]

at the works of Precision Metal Spinnings (Stratford-on-Avon), Ltd.

Arc Manufacturing Co., Ltd., Actarc Works, Nitshill, Glasgow, S.W.3. Stand No. 7, Row X, Ground Floor, Empire Hall

The company's range of single-operator welding transformers, argon-arc welding rectifiers of various capacities, and a selection of welding accessories are being shown, together with three new developments. The latter comprise the Actarc semi-automatic carbon-dioxide welding unit, a redesigned Polytrode high-frequency ionizer unit, and a 3-phase welding rectifier.

The semi-automatic carbon-dioxide welding unit comprises a light-weight water-cooled hand gun, a combined wire drive and control unit, and a 600-amp. constant-potential silicon rectifier. This wire-drive unit can be mounted on top of the rectifier, or slung from a rail or gantry to facilitate access to difficult welding positions. It incorporates a mechanically-governed wire-feed motor; dual-drive feed rolls; post-purge gas and water timer also solenoids; a safety water-pressure switch; and control relays. The rectifier is rated for 100 per cent automatic duty cycle and has a voltage range of 0 to 45·4, at rated load. Optional equipment available with this unit includes a cooling water recirculator, a CO_2 pressure regulator and flowmeter, and a Stellaweld reactor for use in connection with light gauge and positional welding. The Actarc Polytrode equipment, which has been redesigned, has a spark gap ionizer to facilitate arc welding by superimposing a high-frequency current on the normal low-voltage welding current. This equipment can be used in conjunction with standard a.c. or d.c. welding machines for operations on non-ferrous metals such as aluminium, brass, bronze, and Monel, with coated electrodes. It also reduces the welding current required for light-gauge mild-steel sheets, and is claimed to be particularly useful for inert gas welding with transformers or d.c. generators.

With the new 3-phase rectifier, it is stated, the welding characteristics associated with d.c. are combined with the economies of a.c. equipment. The current range is 50 to 450 amp. and the rating, to B.S.S., 400 amp. at 35 volts.

W. Kennedy, Ltd., Station Works, West Drayton, Middlesex. Stand No. 12, Row D, Grand Hall

This company is showing a selection from their range of hand-operated and motor-driven machines for bending reinforcing rods for concrete, pipes, angle sections and copper tubes up to 2 in. diameter. In addition, Refix bending machines for handling pipes up to 3 in. diameter are on view,

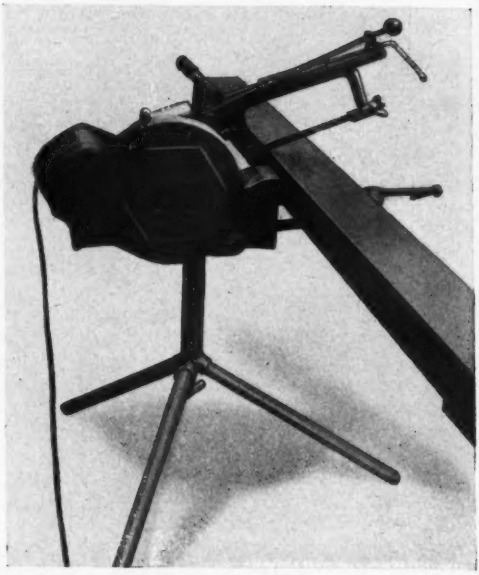


Fig. 12. Kennedy 3½-in. capacity power hacksaw for which petrol-engine drive is available

also the Kennedy Mark 2 portable hacksawing machine, which has a capacity for cutting bars up to 2⅝ in. diameter.

Another exhibit is the recently-introduced hacksawing machine illustrated in Fig. 12, which will handle bars up to 3½ in. diameter. It has been developed from the Mark 2 machine, and may be supplied, if required, with a petrol engine drive.

George Angus & Co., Ltd., Gear Division, Prince Consort Road, Hebburn-on-Tyne. Stand No. 12, Row AA, First Floor, Empire Hall

Among a range of light-duty geared motors shown on this stand is included the Angus ball drive unit of patented design, in which ball bearings are employed to provide an epicyclic friction drive, for either increasing or reducing speed. The ratio obtained per stage ranges from 2·4:1 to 3·2:1, depending on the type and size of bearing. By employing a number of bearings and connecting the cage of one to the race of the next, higher ratios can be obtained. Pressure between the balls and their races, for driving purposes, is applied axially through the medium of helical springs or dished annular spring washers.

Other exhibits include a range of standard double helical reduction units which can be supplied for transmitting up to 300 h.p. These units

are particularly intended for applications involving high input speeds. Mention may also be made of the Angus hydraulic winches which are made in sizes from 25 to 250 h.p., for marine applications.

Pearson Machine Tool Co., Ltd., Walker, Newcastle-upon-Tyne, 6. Stand No. 13, Row H, Grand Hall

This company's exhibits include their latest 300-ton capacity hydraulic flanging press which has a 14 ft. 3 in. long bed. Micrometer adjustment is provided for controlling the working travel of the flanging slide in each direction.

In addition, there is a recently-introduced bevel shearing machine, which has a capacity for handling mild steel plates up to 10 ft. long by 1 in. thick. With this machine, any bevel angle from 0 to 35 deg. can be cut on the edges of steel plates, in preparation for welding, and provision is made for adjustment of the shearing angle of the cutting blade.

A hydraulic power pack on view is representative of a range made by the company in various sizes with delivery capacities from 4 to 38 gal. of oil per min. at pressures up to 4,000 lb. per sq. in. Of compact design, the unit incorporates a Pearson multiple-cylinder radial-type hydraulic pump, also a control valve, an adjustable relief valve, and a pressure gauge.

Hotfoil Flat-element Electrical Heating Tapes

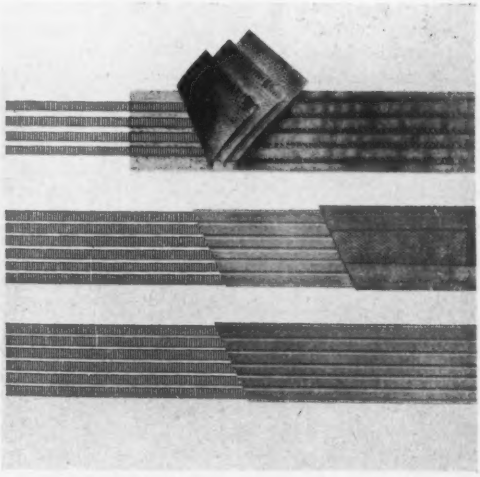
Flat elements made from metal foil are incorporated in Hotfoil electrical heating tape, which is protected by a number of patents and has been introduced recently by Midland Electric Installation Co., Ltd., Cyprus Works, Upper Villiers Street, Wolverhampton, a member company of the Deritend Group. Owing to the large element area which is thus presented to the surface to be heated, it is claimed, a high rate of heat transfer is obtained and there is a comparatively low temperature differential between the tape and the object. Small-pitch corrugations are formed across each element, for the entire length, to provide flexibility and to allow for stretching in the event of a load being applied.

Tapes are available in three forms, cut-away examples of which are shown in the accompanying illustration, and the type A, seen below, is suitable for heating up to 110 deg. C. Individual elements in this tape are encased in Melinex, polyester plastics insulation, and the entire element system is housed in a sheath of the same material. If required, a pressure-sensitive adhesive film can be applied to one face of the tape, and an earthing screen can also be incorporated. The tape measures 1 in. wide by 0·012 in. thick. For use when greater mechanical protection is required, there is a type E tape, as seen in the centre, which is of similar construction but has an additional outer sheath of woven glass fibre. This tape is 1⅛ in. wide by $\frac{1}{32}$ in. thick.

Suitable for wrapping pipes down to ¼ in. diameter, these tapes are normally made for use on electrical supplies at 230 to 250 volts, and are assembled into complete heating units, with a variety of standard lengths from 12 to 100 ft. The elements can be connected in series, series parallel, or parallel. Flexible terminal leads are provided at one end of each tape.

Intended for temperatures up to 450 deg. C., the type G tape shown at the top of the figure incorporates bare elements, which are protected at either side by three layers of glass fibre cloth, stitched together. This tape, which is also normally made for use on 230- to 250-volt supplies, is 0·060 in. thick, by 1 or 1⅛ in. wide, and loadings may range from 50 to 80 or 4 to 35 watts per ft. It is available in standard lengths from 6 to 70ft. Terminal leads are glass fibre-insulated, and rings are fitted at the ends of the tape, to facilitate mounting.

Special mantles and pads can be supplied, for wrapping round valves and drums, for example, and a range of control equipment is also available



Cut-away examples of the three types of Hotfoil electrical heating tape, which has flat elements

British-built Lees-Bradner 7 HD Gear Hobbing Machines

AN AGREEMENT HAS RECENTLY BEEN CONCLUDED between Precision Gear Machines & Tools, Ltd., Red Ring Works, Bodmin Road, Wyken, Coventry (associates of National Broach & Machine Co., Detroit, U.S.A.), and The Lees-Bradner Co., Cleveland 11, Ohio, U.S.A., whereby the former will build and sell the Lees-Bradner type 7 HD single-spindle, high-production, gear hobbing machine in this country.

A general view of the machine is given in Fig. 1, and it has been designed for high rigidity, simplicity of setting and ease of adjustment. The machine has capacity for cutting teeth up to 4 d.p. in steel, and the maximum diameters of gears that can be handled are 8 in. with a 3-in. diameter hob, and 7 in. with a 4-in. diameter hob. Helix angles may range up to 45 deg., right- or left-hand. On machines with the standard column, the maximum length of work admitted is 33 in., and the maximum face width of gear that can be cut, 20 in. When a long column is provided, the corresponding figures are 45 and 32 in. Hobs up to 4 in. diameter by 4 in. long can be used, and axial hob shift of 3½ in. is provided. The diameter of the hob arbor is 1¼ in., and the taper socket in the nose of the work spindle is No. 14 B & S.

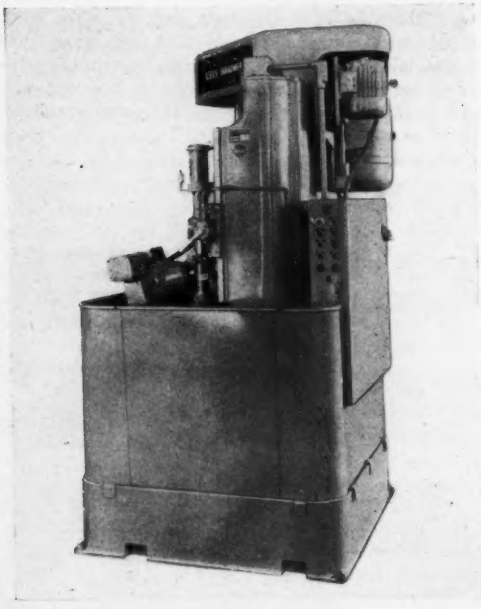


Fig. 1. The Lees-Bradner type 7 HD single-spindle gear hobbing machine which is now being built by Precision Gear Machines & Tools, Ltd.

Fig. 2 shows the working zone of the machine, and attention is drawn to the new hob head, which is equipped with Timken taper roller bearings for the hob spindle. To enable hob heads to be readily interchanged without the need for matching gears, the bevel gear assembly for the hob-head drive forms an integral part of the head.

An outboard support of new, heavy-duty, design is provided for the hob arbor. The support travels axially with the arbor when hob shift is employed, and it slides in an oil-hardened, semi-cylindrical guideway, which is ground and lapped. It is claimed that this sliding support ensures that the hob arbor has greater rigidity than is possible with a conventional outboard support, which must be mounted some distance away from the hob in order to permit hob shifting. Double-row Timken precision taper roller bearings are incorporated, and the design of the unit prevents the entry of dirt and swarf.

Hob shift is actuated by an independent motor, of ⅛ h.p., and special attention has been paid to ease of control of this motion. The amount of shift is pre-selected by means of a graduated ring, which is housed beneath a transparent plastics cover at the end of the head, and is calibrated in increments of 0·001 in., from 0·005 to 0·040 in. Amount of shift required is determined with reference to the circular pitch and the number of gashes in the hob, and the hob is maintained on centre as it is moved axially.

Forward shift is obtained by pressing a "hob advance" push-button, and is effective only at the end of a hobbing cycle, with the main motor stopped. For reverse shift there is a "hob return" button, which is electrically interlocked to ensure that the hob is out of engagement with the work and the main motor stopped, before the movement is started.

An electric counter is set to indicate the number of cycles between successive hob shift motions.

When the last cycle of the pre-set number has been completed, a green signal lamp on the control panel is lit. The operator then presses the "hob advance" push-button, and the hob is moved through the predetermined shift distance while the workpiece is changed. At the start of the next cycle, the green lamp is extinguished, and after the last hob shift, a red lamp is lit. The electrical interlocking system then prevents further hob shifting or hobbing cycles until the hob has been re-set.

Drive is taken from a 10-h.p. main motor, which, with the rapid brake unit, is mounted at the top of the column, to the rear, where it is free from coolant and swarf, and is transmitted to the hob head and table by a main backshaft of 2-piece construction. The upper shaft and bearing assembly can be removed without disturbing the lower portion, and the latter runs in a Timken taper roller bearing, which can be readily adjusted from above.

Vertical movement of the head is effected by a screw and double nuts, so that climb hobbing can be carried out. Axial loads are taken by a double Timken bearing at the upper end of the screw, which is readily adjustable, and the lower bearing is free to float axially. To accommodate high speeds and feed rates, also to permit the application of climb hobbing, the screw has an unusually deep, heavy-section thread, and the nuts are adjustable to eliminate backlash. Power is transmitted to the screw through a patented differential assembly, and rapid traverse clutches are not used. For the feed traverses, the differential case is locked, and drive is transmitted directly to the screw. When rapid traverse is required, the case is driven by a separate motor to rotate the screw at high speed.

Automatic in-out feed mechanism, of patented design, is incorporated, whereby the hob is advanced mechanically to full depth, as governed by a positive stop, at the start of a cut, and withdrawn at the end of the cycle in readiness for the rapid return motion. The advance and return motions are derived from a separate motor, through worm and spur gearing which drives a cam. Motion is imparted to the hob head by a follower and a spring, and once the stop is engaged, further motion only serves to compress the spring. A precision cross-feed screw, with an easily read dial, provide for independent adjustment for work diameter and hob size, with the hob slide in the "in" or "out" positions.

All motions during hobbing are controlled electrically by means of push-buttons, and the machine normally operates on an automatic rectilinear cycle. The stages provide for rapid return of the hob slide, advance to cutting depth, feed downwards for cutting, withdraw to clear the work, and stop. All these motions can be engaged manually when setting up.

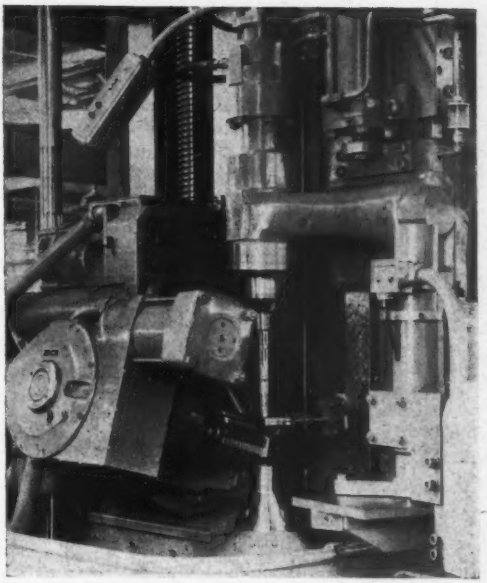


Fig. 2. Close-up view of the hobbing head, tailstock and spindle nose of the type 7 HD machine

Machined from an alloy steel forging, and hardened and ground, the work-spindle runs in bronze and anti-friction bearings, with adjustment for thrust and journal loads. The indexing worm is housed in a cartridge assembly, with provision for eliminating backlash. Opposite flanks of the worm are identical, so that it can be run in either direction. Change gears for indexing, also for the feed mechanism, are located at the front of the machine, and are readily accessible. The tailstock is raised, lowered and clamped by a single lever, and air- or hydraulically-actuated centres can be supplied.

The type 7 HD machine is supplied with a coolant pump, and occupies a floor space of 41½ by 44 in.

PRODUCTION OF DOMESTIC WASHING MACHINES in the U.K. during the year 1960, averaged 84,900 per month, of which 19,300 machines per month were exported. The average values of machines produced and exported per month were £3,510,000 and £566,000 respectively.

NEWS OF THE INDUSTRY

The South

CARBIDE IMPREGNATION, LTD., Hemel Hempstead, Herts., are steadily expanding the facilities available at their works for the treatment of twist drills, reamers, milling cutters, and a wide variety of other tools by a process of tungsten-carbide impregnation, whereby, it is claimed, the wear resistant properties of the cutting edges are enhanced. Punches and form tools are frequently accepted for impregnation treatment, and it is stated that the useful life of such parts is considerably lengthened at relatively low cost. Scissors and certain types of surgical instruments are also said to have improved cutting action when impregnated, and we understand that business in this field is increasing. Specially adapted electro-erosion equipment is employed for the process of tungsten-carbide impregnation employed by the company, and because of the growing demand for this service, additional apparatus is to be installed.

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New machines exhibited on the stand of Dowding & Doll, Ltd., at the recent Leipzig Spring Fair, included this R.G. hydraulic press of 10 tons capacity, the intermediate size from a range of three. The press is self-contained, and the force is applied by a direct-acting cylinder. A regulating valve fitted in the supply line to the ram cylinder enables the speed to be reduced to a value suitable for broaching operations. The press shown was equipped with a 4- or 8-station, hydraulic rotary table, which has a separate hydraulic system and can be operated in synchronism or independently of the press. The holes in the table are on a pitch circle of 12 in. diameter. Other machines shown by the company included a V4 gear hobber, an H7 horizontal universal hobber, Wiedemann R4 hand- and RA41P power-operated turret punch presses, an Ahcol Rotomil rotary milling machine, and an Accuratool automatic air-operated capstan lathe

AIR TOOL & ACCESSORIES, LTD., Ebburns Road, Hemel Hempstead, Herts., continue to extend the range and variety of the pneumatic tools and accessories which they distribute. In this connection it may be noted that they have acquired the agency for Britain for the Bux light-weight magnetic drill base for portable power tools, which was exhibited at the recent E.I.A. display held in Hitchin, Herts. A rising demand is reported for portable pneumatic tools, including Prelu turbine-driven air units designed for operation at spindle speeds up to 90,000 r.p.m. when fitted with grinding wheels or tungsten-carbide burrs There is also an increasing interest in rotary sanding, wire brushing and polishing tools; reinforced resin-bonded, depressed-centre, cut-off discs; and associated flexible shaft drives and compressed air motors.

CAM PROFILES, LTD., Waverley Road, St. Albans, Herts., are busy with orders for cams of different types for makers of a wide range of machinery, including, for example, counting machines and book-binding machines. The company has developed a number of interesting grinding machines for producing cam profiles to close limits. Work undertaken includes single- and multi-track cams, also face cams with external peripheral gearing, and cams with double-spiral grooves. The equipment installed permits the generation of tracks in cams up to a maximum of 30 in. outside diameter.

FARQUHAR MACHINE TOOLS, LTD., Dallow Road, Luton, Beds., are experiencing a lively demand for

machine tools, especially milling machines and centre lathes. This company deals in a wide range of machines—both new and used—and activities in this field are being expanded.

DICKHURST ENGINEERING CO., LTD., Queen Street, Hitchin, Herts., are providing a tool regrinding service for an increasing number of firms in Hitchin and surrounding areas. Included among the wide variety of cutting tools accepted for servicing by this company are end-mills, slab mills, side and face cutters, inserted-tooth type cutters with cemented carbide tips, slitting saws, and threading dies. Work is collected and delivered by arrangement and in the event of an emergency, tool servicing can generally be expedited. Finished work is protected with Gloscote strippable compound. A section of the works is equipped with Myford centre lathes and Britan repetition lathes for the production of parts involving short and long runs.

PAR-TOOL FILTERS, LTD., Essex Street, Luton, Beds., report a growing demand for their range of single- and multi-element filters which are becoming widely adopted in industry. Filter elements provided for use with the equipment are of different types and are classified as either expendable or recoverable. The former are made of cellulose, paper sheet, carbon mat, or glass fibre, and the latter, from sintered bronze, woven stainless steel or ceramic material. By selection of the filtering medium, the maximum particle size of solid matter remaining in a fluid after filtration may be controlled. Thus, an element with a minimum particle retention of 3-7 microns may be employed for filtering the coolant for precision grinding machines, and another, designed for more intensive filtration, may be employed for removing suspended matter from honing fluids. Par-Tool filter installations of ample size for cleaning the coolant returned from a number of machine tools to a central reservoir have been provided, and others take the form of triple conditioning units, comprising three filters, for dehydrating, neutralizing, and clarifying coolant supplies.

PROTOTYPE DEVELOPMENTS, LTD., Arundel Road, Luton, Beds., continue to be well placed for work involving the production of a variety of close-limit machined parts. This company also produces the Protoscope vertical optical projector which may be employed for viewing screw threads and profiled parts in daylight. The Mk. 3 version of the projector is now finding an expanding market, and has many applications in the smaller shops. An object holder is arranged for full circle rotation, and accurate adjustment, by micrometers, in a horizontal plane. Images of objects held between mounting centres are projected at magnifications of 10× or 20× on to a 9-in. diameter, radially-calibrated, plastics-faced viewing screen, which is shielded from extraneous light by an adjustable curtain. The illumination system provided permits both surface and outline viewing of the work. Permanent records of projected images may be made on fast photographic paper or dyeline paper.

F. W. HERRIDGE

Stockport and District

WM. MOSS & SONS (STOCKPORT), LTD., Carrs Spindle Works, Lower Carrs, Stockport, in addition to producing a range of textile spindles, undertake a wide variety of contract machining work for the engineering industry. The contract machining department of the works includes centre lathe turning; drilling; milling; grinding—including centreless grinding; and semi-automatic lathe sections. It was noted that a certain amount of capacity is at present available in all sections.

F. E. ROWLAND & CO., LTD., Climax Works, Station Road, Reddish, Nr. Stockport, report that their works are fully occupied with the production of various types and sizes of grinding machines. The demand for their Duplex surface grinder remains steady, and repeat orders are in hand from many users.

The works extension to the fitting and assembly bay has been completed and is already fully occupied.

WHARTON CRANE & HOIST CO., LTD., Station Road, Reddish, inform us that there is a continued demand for their range of products. The works are at present occupied with the production of a variety of overhead-type electrically driven cranes. A 150-ton capacity crane for use in connection with power station installation work was recently despatched.

S. H. HEYWOOD & CO., LTD., Station Road, Reddish, report a good demand from steel works, foundries, and all branches of the engineering industry, for their range of electrically-driven overhead travelling cranes, ranging up to 100 tons capacity. Various sizes of cranes are at present in production for delivery to both the home and export markets.

RHODES, BRYDON & YOUATT, LTD., Reddish Works, Furnival Street, Reddish, makers of many types and sizes of pumps, report an increased demand for their products for handling acids and other chemicals and molten metal, also for use with heating and ventilating equipment.

A recent addition to the range is the S.C. Mopump which has been designed for use with "packaged boilers" and is capable of generating high heads while delivering relatively small volumes of liquids. A fully descriptive leaflet has been produced covering these new pumps. The company will show a range of equipment at the Heating, Ventilating and Air Conditioning Exhibition which is to be held at Olympia in September and October.

CROWTHORN ENGINEERING CO., LTD., Atlas Works, Reddish, are working to capacity on their range of lathes from 7¼ in. to 18 in. centre height, boring and facing lathes, and 10¼/12½-in. combination turret lathes. A steady demand is being experienced for the 7½-in. centre lathe from technical education establishments, and the most recent order was placed by the Hastings College of Further Education. An increasing volume of orders is reported for the 19½-in. stroke shaping machine which is now being supplied, as standard, with double helical gearing and automatic power operated down-feed.

Recent export orders have come from China, Canada, Gibraltar, Angola, and the Irish Republic, among other countries. We may also note that several orders are in hand for various departments of the Admiralty. Another recent order, placed by Cooper Roller Bearings, Ltd., King's Lynn, is for a 8½-in. turning and boring lathe, fitted with a special spherical boring attachment.

Machines at present under construction include six lathes for the Dounreay Experimental Reactor Establishment, Thurso, Caithness, also a new design of 10½-in. centre, turning, boring and parting-off lathe, which is a heavier version of the previously available machine. It is powered by a 12-h.p. motor and is provided with front and rear tool-holders on separate cross-slides, hydraulic chucking equipment, overhead pilot bar, quick power traverse, and automatic feed trips. A David Brown gear hobbing and gear shaving machine is shortly to be installed in the works.

We are informed that the main factor affecting delivery of machine tools is the extreme shortage of skilled labour, particularly planing machine, boring machine, and lathe operators.

R. SUTCLIFFE.

The Work of the U.K.A.E.A.

At a trade luncheon of The Gauge and Tool Makers' Association held recently at the Savoy Hotel, London, the Guest of Honour, Sir Roger Makins, G.C.B., G.C.M.G., chairman of the United Kingdom Atomic Energy Authority, was introduced by Sir Stanley Harley, B.Sc., M.I.Mech.E., M.I.Prod.E., president of the G.T.M.A.

Sir Roger, who spoke about the work of the Authority, paid tribute to the considerable assistance which had been given by many members of the Association in connection with the development of new techniques for the handling and machining of radio-active materials. He also mentioned the work that was being done by the Authority in connection with the training of craftsmen, technicians, and engineers, in the field of high precision engineering.

The Authority, he continued, was divided into five groups concerned with research, development of reactors, engineering, production, and weapons. Atomic energy development in this country had been powerfully assisted by military requirements. The main facilities had been erected in support of the weapons programme, which continued to account for an important and substantial part of their work. In connection with civil applications, Sir Roger first drew attention to the activities of the Radio Chemical Centre at Amersham which, supported by the research and development facilities at Harwell and Wantage, was already selling isotopes to the value of about £1,250,000 per annum. Of that total, moreover, 60 per cent was exported to some 60 countries. Many applications of isotopes were already well known, but to ensure greater understanding of the potentialities, an Isotope Information Bureau, at which visitors were welcome, had recently been opened at the London office of the Authority.

Our civil power programme was based on three generations of gas-cooled, graphite moderated, reactors, namely Magnox—the Calder Hall type; the advanced gas-cooled reactor; and the high temperature gas-cooled reactor. Good results had been obtained with the Calder Hall and Chapelcross reactors, the first of which had run for more than four years. In the large civil power reactors, the first of which was expected to be commissioned this year, the fuel element conditions would be more arduous. Experience with the Calder Hall reactors could not therefore be regarded as conclusive, but it had been encouraging.

The experimental advanced gas-cooled reactor at Windscale would start up in the autumn and was expected to give invaluable working confirmation of

the technical advances which the system afforded. Represented by the so-called Dragon project at Winfrith Heath, in Dorset, the high-temperature gas-cooled reactor was a much more sophisticated and advanced design with much higher temperatures. There were many problems to be solved, and it was definitely a "third generation" reactor for the 70s.

Because our resources had been necessarily limited, the United Kingdom had had to be selective as regards systems, but Sir Roger thought that the "gas-cooled route" would in the end prove to have been the best.

There had been some delay in running the fast reactor at Dounreay up to useful power owing to the entrainment of gas and the presence of impurities in the liquid metal used as coolant. These difficulties had been identified and were being dealt with. The Authority's main concern, at present, on the fast reactor side, was to specify the fuel for a prototype civil power reactor. In the development and testing of this fuel, the Dounreay reactor would be a "key tool." Since the best utilization of plutonium coming from the civil power reactors would be in fast reactors, there was a powerful incentive to solve the technical problems associated with the system.

Most assumptions made in 1956, in all countries, concerning the cost of nuclear power had proved to be wrong. An exception had been the predictions about capital and unit costs of nuclear power stations and the probable fall in cost of construction. Since 1957 the capital cost of civil nuclear stations had, in fact, fallen by 38 or 39 per cent, and the cost of electrical generation at these stations, at about the same rate. The first civil stations would not be competitive and were never expected to be. He believed, however that nuclear power would become competitive at base load, towards the end of this decade. Meanwhile, the extra cost to the consumer of nuclear generation, when spread over the whole system was insignificant—a negligible premium for the introduction of a third fuel into the economy.

Nuclear power was on its way, here and in many other countries, and it was his own view, said Sir Roger, that the present mood of uncertainty about its prospects would, as experience of large power reactors was accumulated, give way to renewed confidence in the future. In conclusion he drew attention to the very high standards that were demanded as regards safety.

Mr. G. P. Barrott, M.I.Prod.E., chairman of the Gauge and Tool Makers' Association, proposed the toast of "Our Guests" and Mr. J. C. Snow, president of the Machine Tool Trades Association, responded.

K.S.M. Stud Welding Equipment

Capacitor-discharge stud welding equipment developed by K.S.M. Products, Inc., Moorestown, N.J., U.S.A., has recently been placed on the market in this country by an associate company, K.S.M. Stud Welding, Ltd., High Street, Old Woking, Surrey.

This equipment enables studs and pins in a wide range of shapes, and in sizes from 6 B.A. up to ¼ in. diameter, to be welded to steel plates which may have thicknesses of the order of 22 s.w.g. Welding may be carried out by a portable gun as shown in the figure, which is connected to a power unit by flexible cables, or on a floor-mounted, single- or multiple-head machine. When a pin or stud to be welded has been inserted in a collet in the gun, an adjustable foot at the nose end is brought into contact with the plate. This action causes the collet spindle to be moved within the gun in an axial direction, to compress a spring, so that a small pip at the end of the pin is held in contact with the plate under pressure. A push-button incorporated in the gun is now depressed with the result that capacitors built into the power unit are discharged to apply a current of the order of 5,000 amp. at a low voltage, which has the effect of melting the pip metal at the end of the stud and the plate.

The stud is then moved into contact with the plate under the action of the spring to complete the welding operation, which is completed in a cycle time of approximately 6 milli-sec.

K.S.M. stud welding gun

Since the metal in the plate is melted for a depth of only 0·002 to 0·10 in., burning and marking of the opposite side is avoided. In consequence, the equipment may be used for welding studs to parts which have been painted or made from plastics-coated metal. With the K.S.M. system ceramic ferrules are not employed, and mating components made from similar or different ferrous and non-ferrous metals may be welded.

The equipment is intended to be operated from a 3-phase supply of 110 or 240 volts, through a 13-amp. socket, for example, and as soon as a welding cycle has been completed, the capacitors are charged in readiness for welding the next stud. In consequence, the equipment can be maintained in continuous operation, and studs can be welded at the rate of 10 to 12 per min. A knob is mounted on the power unit for adjusting the supply voltage, to suit the diameter of the studs to be welded.

The Growing Importance of Ultrasonics

(*Continued from page* 987)

tant possibilities in connection with certain grinding operations. This new system involves, in effect, an extension of the ultrasonic cleaning technique to grinding wheels for the purpose of eliminating or reducing the build-up of metal particles. A transducer is mounted close to the surface of the grinding wheel—normally at the top—and through it water-based coolant is pumped so that it flows continuously on to the wheel. Vibration imparted to this coolant, it is stated, will not remove very small metal particles which initially become lodged in the spaces between abrasive grains. It is contended, however, that it is very effective in preventing subsequent accumulation of particles which would lead to loading. In consequence, it is claimed, the wheel is maintained in a free-cutting condition and will run for much longer periods between dressing operations than would otherwise be possible.

Apart from very substantial increase in wheel life, it is reported that the cleaning action enables grinding operations to be performed more rapidly and close tolerances—for example, for flatness—to be more readily maintained. In addition, thin workpieces can be ground with less risk of warping or burning and good surface finishes can be obtained. As an indication of the results that may be expected, the particulars of the following test are of interest. Stainless steel was ground under otherwise identical conditions, and without ultrasonic cleaning, the removal of 0·057 in. of stock involved wheel wear of 0·009 in. and a surface finish of 35 micro-inches was obtained. With ultrasonic cleaning, 0·108 in. was removed for a wheel wear of 0·0015 in. and the finish was 8 micro-inches.

The utilization of ultrasonic vibration to produce effects of practical value is still comparatively new, and despite the variety of applications that has already been found, there is no reason to suppose that the potentialities have yet been fully explored.

New Companies Registered*

WILSON-BAKER, LTD., East Street, Braintree, Essex. Registered April 10, 1961. To take over the business of an engineer carried on as "Royce Engineering Company" at Braintree by L. C. Wilson Baker, etc. Nom. cap.: £5,000 in £1 shares. Directors: L. C. W. Baker and Mrs. B. M. Baker.

OBERG-SANKEY, LTD. Registered April 13, 1961. To carry on the business of designers and manufacturers of and dealers in high precision tools of all kinds, particularly high precision dies in tungsten carbide, etc. Nom. cap.: £50,000 in £1 shares. Directors to be appointed by subscribers. Subscribers: G. Sankey, Tong Lodge, near Shifnal, Salop, and R. A. Pearson, Beech House, Shifnal, Salop.

KLOCKNER STEEL CO., LTD., 1-6 Essex Street, London, W.C.2. Registered April 7, 1961. Nom. cap.: £50,000 in £1 shares. Directors: T. C. L. Parker, H. J. Sendler H. E. Amos, E. Wortberg and G. Froning.

*From the lists compiled by Jordan & Sons, Ltd., Company Registration Agents, 116-118 Chancery Lane, London, W.C.2.

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Bull, John, Rubber Co., Ltd., Mechanical Products Division	1019
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Crossley Bros., Ltd.	1018
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Felco Hoists, Ltd.	1016
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Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

Type of Machine	Month ended February 28, 1961	Two months ended February 28	
		1960	1961
	Value £	Value £	Value £
New, complete:—			
Bar and chucking automatics	97,814	149,922	168,997
Boring machines:			
Vertical	104,324	85,080	276,033
Other	52,932	231,902	184,427
Drilling machines	165,513	241,547	289,873
Gear-cutting machines	48,816	243,926	158,860
Grinding, lapping and honing machines	345,172	387,824	630,059
Lathes:			
Capstan and turret	217,575	340,338	529,680
Other	282,354	629,217	641,798
Milling machines	200,435	409,862	458,794
Planing machines	29,843	45 031	83,456
Presses:			
Hydraulic	21,893	305,081	139,053
Other	104,825	125,662	234,651
Punching and shearing machines	59,875	81,224	154,723
Other plate and sheet metal-working machines, including straightening rolls	31,296	104,713	127,656
Screwing and threading machines	98,362	191,121	209,433
Shaping and slotting machines	42,540	82,172	91,085
All other machines	342,965	487,202	730,995
Used, complete	39,347	134,392	76,701
Parts	368,840	438,791	836,093
Total	2,654,721	4,715,007	6,022,366
Destination			
Union of South Africa	109,713	177,982	257,453
India	380,755	460,452	987,573
Australia	446,703	1,066,807	902,619
New Zealand	64,786	60,704	157,291
Canada	120,575	245,495	257,662
Other Commonwealth countries	124,493	286,523	361,456
Soviet Union	55,345	68,364	166,690
Sweden	94,844	122,905	166,295
Western Germany	127,019	144,227	277,025
Netherlands	60,526	88,686	156,718
France	44,198	285,093	265,300
Spain	38,917	110,706	119,327
Italy	156,501	93,933	341,901
United States of America	113,958	519,681	250,922
Other foreign countries	716,388	983,449	1,354,134

IMPORTS OF MACHINE TOOLS

New, complete:—			
Bar and chucking automatics	71,823	100,883	154,156
Boring machines	64,751	253,868	130,774
Drilling machines	20,399	42,360	57,677
Gear-cutting machines	373,223	30,232	624,179
Grinding, lapping and honing machines	402,403	494,754	850,544
Lathes	266,294	285,649	559,962
Milling machines	262,666	445,236	495,067
Planing, shaping and slotting machines	14,588	29,197	94,672
Presses	123,221	143,158	249,826
All other machines	459,755	537,866	837,868
Used, complete	67,284	235,929	125,562
Parts	278,786	420,190	589,944
Total	2,405,193	3,019,322	4,770,231
Country of Origin			
Western Germany	641,777	859,984	1,293,910
Switzerland	237,139	391,780	568,576
U.S. America	1,082,872	1,039,255	2,035,850
Other countries	443,405	728,303	871,895

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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3/5/61

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That it shall not, without the written consent of the publishers first given, be lent, resold, hired out or otherwise disposed of by way of trade except at the full retail price of 1s. 3d. and, that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in an unauthorised cover by way of trade; or affixed to or as part of any publication or advertising literary or pictorial matter whatsoever.

Industrial Notes

THE COMPOFLEX GROUP have opened a warehouse at 9-11 Bordesley Green Road, Birmingham, 9, in which both flexible and rigid tubing is stocked.

BRITISH TRADE FAIR IN MEXICO POSTPONED.—The British Trade Fair which was to have been held in Mexico City from February 16 to March 4, 1962, has been postponed.

AN AUCTION SALE OF VEHICLES, MACHINE TOOLS and miscellaneous stores will be held at the W.D. Storage Depot, Bowhouse, Hurlford, Nr. Kilmarnock, Ayrshire, on May 11. The auctioneers will be Dixon & Wallace, Ltd. (Dept. N), Bank Buildings, Graham Square, Glasgow, E.1.

CHARLES TAYLOR (BIRMINGHAM), LTD., inform us that the staff and equipment from the branch works formerly located at Smithfield Passage, Birmingham, 5, have been transferred to the new extension at the head office site. All correspondence in future should be addressed to Bartholomew Street, Birmingham, 5.

ASQUITH MACHINE TOOL CORPORATION, LTD., Halifax, have recently received orders from Japan for machine tools valued at £150,000. The greater part of this total is accounted for by a large horizontal boring and milling machine which is to be supplied to a company in the heavy electrical industry.

NORTHAMPTON COLLEGE OF ADVANCED TECHNOLOGY, St. John Street, London, E.C.1, are to hold a Summer School for Computers and Production Technology, from June 12 to 16, from 10 a.m. to 4.15 p.m. daily. Enrolment for the course will be limited to 30 people, and applications should be made, not later than May 26, to the secretary of the College.

THE COIL SPRING FEDERATION, 301 Glossop Road, Sheffield, 10, and the associated Research Organization, will be holding a joint annual conference at the Palace Hotel, Torquay, from May 11 to 14. The programme will include a technical session at which Mr. R. A. Varo will present a research paper dealing with the static mechanical properties of British, German, and Swedish spring wires.

T. S. HARRISON & SONS, LTD., Heckmondwike, report that in addition to their recent successes in the United States, they have received an order from their agents for Western Germany, which covers deliveries for 1962. The number of lathes involved is 360 of an approximate value of £150,000, and the order is additional to one already placed for this year and valued at £50,000.

ALFRED HERBERT, LTD., Coventry.—Speaking at the recent annual general meeting of the company, the chairman, Col. C. W. Clark, D.S.O., O.B.E., M.C., indicated that orders for machines and accessories "which we make in our shops or distribute for other makers" were continuing to come in at a rate which was well in excess of output, and that every effort was being made to increase production.

CONFERENCE ON NOISE CONTROL.—The problem of controlling noise will be discussed at a 3-day conference starting on June 26, at the National Physical Laboratory, Teddington, Middlesex. It is being organized by the N.P.L., the Building Research Station, and the National Engineering Laboratory of the D.S.I.R. The discussions will cover many aspects of the problem at work and in the home, but too narrow concentration on specialized techniques will be avoided. Admission will be by personal invitation, and those interested should write to the Director, National Physical Laboratory, Teddington, Middlesex, for further information.

RUBERY OWEN & CO., LTD., Foundry Equipment Department, Empress Works, Walsall Road, Willenhall, Staffs., will show a one-tenth scale working model of the Hallsworth automatic moulding equipment at the forthcoming British Trade Fair in Moscow. It will be the first occasion on which this system for the production of small ferrous and non-ferrous repetition castings will be demonstrated overseas. Small easily handled boxes are employed in conjunction with completely automatic equipment, where necessary, but the human element can still be retained if there is economic justification.

RANK PRECISION INDUSTRIES (BAF), LTD., 37 Mortimer St., London, W.1, have introduced a system to facilitate observation of various "break-in danger points" of one or more factories from a central observation post. With this system, for example, several small factories on a trading estate could combine to guard against robberies. Concealed TV cameras are provided at the various positions that are required to be under surveillance, and constantly transmit pictures of the area to TV monitor screens at the central control point, which is manned by a single guard, day or night.

ANGLO-SOVIET TRADE.—In his presidential address to the 45th annual general meeting of The Russo-British Chamber of Commerce, Sir Greville S. Maginess, K.B.E., drew attention to the increase in trade between the countries in 1960 as compared with 1959. Our exports rose from £27·5 to £37 million, and re-exports (almost entirely rubber) from £7·4 to £16·1 million. At the same time, our imports from U.S.S.R. increased from £63 to £74·9 million.

The growth of trade in 1960, said Sir Greville, was encouraging, but there was plenty of opportunity for further expansion, and they looked forward, with confidence, to still higher figures for the current year.

DAVID BROWN INDUSTRIES, LTD., Huddersfield, are to open a new factory at Sunderland, where it is planned eventually to employ about 400 people. This scheme, it is stated, has been necessitated by the urgent need for more space to enable output to be increased, by the fact that the Park Works site is already completely built up, and by the difficulties of obtaining further labour to permit expansion in Huddersfield. Initially the Sunderland factory, for which the required labour will be readily available, will be employed for the production of Radicon worm gear units, and the space thus released at Huddersfield will be utilized to augment the productive facilities of other departments. It is emphasized that the existing labour force at these works will continue to be fully utilized.

Personal

MR. GEOFFREY KEELING is now responsible for the production and sales of Orcutt machine tools made by The Gear Grinding Co., Ltd., Shirley, Warwickshire, and Mr. Jack Payne for all matters concerning the sales and production of gears.

MR. SYDNEY POLKINGHORN, formerly commercial manager of Compoflex Co., Ltd., has set up in business as a trade and export consultant, and manufacturers' agent, specializing mainly in engineering products. He will be visiting Western Germany early in June to conduct market surveys on behalf of a number of British manufacturing organizations.

Mr. Polkinghorn is operating temporarily from his home at Brookfield, Little Abbots Farm, Betchworth, Surrey.

The following new appointments have been announced:—

MR. L. WALKER, M.I.E.I., A.R.Ae.S., M.A.S.Q.C., as chief inspector for The Plessey Group of companies.

MR. M. D. LIPPOLD, as Southern area manager for The Benjamin Electric, Ltd., Tottenham, London, N.17.

MR. T. RICHMOND, as a director of the Titanic Steel Co., Ltd., a subsidiary of Samuel Osborn & Co., Ltd., Clyde Steel Works, Sheffield, 3.

MR. B. W. LYNN, M.P.O.A., M.I.E.I., as general planning and procurement manager of the Perkins Group of companies, Peterborough.

MR. J. GOMBINSKI, as managing director of E. G. Brisch & Partners, Ltd., 26 Victoria Street, Westminster, London, S.W.1, and MR. H. R. WHITTY, as a director of the company.

COL. R. W. W. TAYLOR, as vice president of the British Compressed Air Society for the coming year. Col. Taylor is managing director of Lang Pneumatic, Ltd., Owen Road, Wolverhampton.

MR. J. C. CHILDS, as works manager of Sheepbridge Stokes, Ltd., Chesterfield, a member company of the Sheepbridge Engineering Group. He was previously with an associate company, Sheepbridge Alloy Castings, Ltd., as methods engineer.

MR. F. N. HONEY as general manager, Mr. C. G. HART as sales manager (home), in succession to Mr. Honey, and MR. E. J. METCALFE as Western Area representative of The London Shafting & Pulley Co., Ltd., Collingwood Iron Works, 18-22 Northdown Street, London, N.1.

MR. H. G. HINCKLEY, as manager of the machine tool control department of Ferranti, Ltd., Edinburgh. He succeeds Mr. D. T. N. Williamson who is now director of research and development at Molins Machine Co., Ltd., Evelyn Street, London, S.E.8.

MR. B. S. MOORE, as a technical sales representative in Southern England for Slack Sellars & Co., Ltd., Mowbray Street, Sheffield, 3. His address is 11 Hobart Place, London, S.W.1, and he will take over part of the territory for which Mr. S. A. Spragg was previously responsible.

MR. A. B. MILES, previously chief draughtsman, as chief engineer, and MR. F. MEADOWS, formerly assistant chief draughtsman, as chief draughtsman of Darchem Engineering, Ltd., Stillington, Co. Durham, and MR. D. A. ROWLETT, M.Sc.(Eng.), as manager of the Rostenit (stainless steel lining process) Division.

MR. R. B. HESSELDEN, A.M.I.Mech.E., as a director, and MR. R. BARR, A.M.I.Mech.E., M.Inst.B.F., M.T.I., as works manager of The Holset Engineering Co., Ltd., Turnbridge, Huddersfield.

MR. G. C. HAMMOND, as technical representative for the Midland Area for Embassy, Machine & Tool Co., Ltd., 248 Watford Way, Hendon, London, N.W.4. He will also be concerned with the products of the associate company, F. J. Pistol, Ltd.

BRIGADIER C. J. TOBIN, as a member of the board and works director of Burtonwood Engineering Co., Ltd., Warrington, Lancs. The latter post has been newly created. These appointments will be effective from May 15.

MR. D. L. ROPER, as group sales manager for W. Williams & Sons (Holdings), Ltd., Colchester Factory Estate, Colchester Avenue, Cardiff. He will be responsible for all the sales activities of Williams Alexandra Foundry, Ltd., Dialoy, Ltd., and Bronze Smelters, Ltd.

Coming Events

INSTITUTION OF PRODUCTION ENGINEERS. *Midlands Region.* A one-day conference on "Product Development" will be held at the Winter Gardens and Raven Hotel, Droitwich, on May 10. Tickets of admission may be obtained from the Regional Secretary, Mr. A. C. Turner, Waverley, Church Lane, Whittington, Worcester.

Scrap Metals

MIDLANDS.—In general, scrap for steelworks is moving steadily in the Midlands, and provided it is of the required quality, random deliveries can be made of Grades 1 and 2 heavy steel scrap. To satisfy this demand, merchants are paying good prices for oversize heavy steel scrap for shearing and gas-cutting at their yards.

Although No. 4 bundles are being accepted regularly, it is evident that buyers are reluctant to increase orders for No. 5 bundles at present. Merchants are therefore disposing of more loose light iron scrap direct to local steelworks against orders for No. 6 specification material, provided that all galvanized tinned, enamelled, and coated material is excluded.

Blast furnace turnings are proving difficult to dispose of at present. Prices have eased slightly and allocations have been reduced by some consumers. Both chipped and bushy turnings are affected, and merchants are not anxious to handle increased tonnages. Cast iron borings are held up at one or two works, and production from Midlands factories is being forwarded to markets further afield.

The better grades of short heavy steel can be delivered to local foundries, but difficulty is experienced in finding outlets for general sheared scrap, including piping. Nickel-bearing steels can be handled for delivery to Sheffield markets, prices depending on the alloy content.

All grades of cast iron are wanted for local foundries, but the demand for supplies is not now so acute as hitherto. Merchants are paying good prices for oversize cast, machines for breaking and stripping, and for complete motor-car and lorry engines for cleaning.

Machine Tool Share Market

Stock markets were mainly firm during the period under review, and active conditions prevailed in most sections. Commercial and industrial equities commanded the greatest attention, interest being stimulated by announcements of profits and dividends from a large number of companies, also by other special factors. Share prices improved as a result of widespread investment demand, and, on balance, there were many substantial advances.

The gilt-edged section showed a favourable trend, and at the close there was a general improvement in British Funds and other high grade fixed interest stocks.

Among machine tool issues British Oxygen advanced 6d. to 35s. 6d.; Broom & Wade, 9d. to 28s. 3d.; Clarkson Engineers, 7½d. to 30s. 7½d.; Coventry Gauge & Tool, 2s. to 33s. 3d.; Craven Bros. (Manchester), 4½d. to 10s. 10½d.; Greenwood & Batley, 3s. 3d. to 29s. 6d.; John Harper, 1½d. to 8s. 6d.; John Holroyd "A", 3s. 9d. to 22s. 6d.; John Holroyd "B," 3s. 9d. to 21s. 6d.; H. W. Kearns, 6d. to 24s. 3d.; Kerry's (Gt. Britain), 1s. to 11s.; Macready's Metal, 6d. to 17s. 6d.; Samuel Osborn, 6d. to 59s. 6d.; Sheffield Twist Drill, 6d. to 19s. 6d.; W. E. Sykes "B," 2s. 1½d. to 32s. 9d.; Tap & Die Corporation, 3d. to 19s. 3d.; and Wadkin, Ltd., 1s. to 25s.

On the other hand, Arnott & Harrison lost 3d. at 14s. 6d.; Asquith Machine Tool, 6d. at 13s. 6d.; Chas. Churchill, 4½d. at 9s. 3d.; Alfred Herbert, 6d. at 75s. 6d.; and Thos. W. Ward, 6d. at 79s. 6d.

CRAVEN BROS. (MANCHESTER), LTD. Final dividend of 6 per cent, making, with the interim, a total distribution of 8½ per cent for 1960.

STEDALL & Co., LTD. Final dividend of 10 per cent, making a total distribution of 15 per cent for 1960, as against 10 per cent for the previous year.

Trade Publications

ROCOL, LTD., Rocol House, Swillington, Nr. Leeds.—Leaflet entitled "Rocol Anti-scuffing Products," in which the properties and principal applications of the company's four main molybdenum disulphide lubricants are clearly set out. The range comprises anti-scuffing oil, paste, spray, and powder.

SUFFOLK IRON FOUNDRY (1920), LTD., Stowmarket, Suffolk.—Leaflets concerned with the following products: Super Silicon No. 9 rods for cast iron fusion welding; Sifbronze fluxes for various purposes; S.I.F. stainless steel welding wires No. 20 and 21; and S.I.F. No. 28 silver solder.

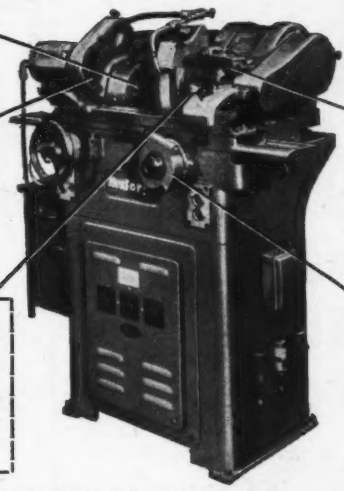
COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/9
Allen (Edgar) & Co., Ltd.	Ord.	£1	44/6
" "	5% Prf.	£1	13/9*
Arnott & Harrison, Ltd.	Ord.	4/-	14/6
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	13/6
" " "	6% Cum. Prf.	£1	16/3
Birmingham Small Arms Co., Ltd.	Ord.	10/-	36/-
" " "	5% Cum. "A" Prf.	£1	14/-
" " "	6% Cum. "B" Prf.	£1	16/6
" " "	4% 1st Mort. Deb.	Stk.	92
British Oxygen Co., Ltd.	Ord.	5/-	35/6
" " "	6% Cum. Prf.	£1	20/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	10/3
Broom & Wade, Ltd.	Ord.	5/-	28/3
" "	6% Cum. Prf.	£1	16/6
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	16/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	16/10½
" " "	5% Cum. Prf.	£1	14/3
Churchill (Charles) & Co., Ltd.	Ord.	2/-	9/3
" " "	6% Cum. Prf.	£1	25/4½‡
Clarkson (Engrs.), Ltd.	Ord.	5/-	30/7½
Cohen (George), 600 Group, Ltd.	Ord.	5/-	14/-
" " "	4½% Cum. Prf.	£1	13/-
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	33/3
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	10/10½
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/7½
" "	4½% Red. Cum. Prf.	£1	12/-
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	2/7½
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	11/-
Greenwood & Batley, Ltd.	Ord.	10/-	29/6
Harper (John) & Co., Ltd.	Ord.	5/-	8/6
" " "	4½% Red. Cum. Prf.	£1	12/-
Herbert (Alfred), Ltd.	Ord.	£1	75/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	22/6
" "	"B" Ord.	5/-	21/6
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	47/-
" " "	7% Cum. Prf.	5/-	4/9
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	11/-
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	24/3
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	11/-
Macreadys Metal Co., Ltd.	Ord.	5/-	17/6
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/6
Massey (B. & S.), Ltd.	Ord.	5/-	12/3
Newall Engineering Co., Ltd.	Ord.	2/-	11/3
Newman Industries, Ltd.	Ord.	2/-	6/-
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	5/6
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	8/-
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	59/6
" " "	5½% Cum. Prf.	£1	23/6
Pratt (F.) & Co., Ltd.	Ord.	5/-	16/10½
Sanderson Kayser, Ltd.	Ord.	10/-	37/6
" "	6½% Cum. Prf.	£1	17/6
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	11/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	55/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	20/1½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	19/6
" " "	5% Cum. Prf.	£1	14/3
Stedall & Co., Ltd.	Ord.	5/-	9/9
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	32/9
Tap & Die Corporation, Ltd.	Ord.	5/-	19/3
" " "	4½% Deb. 1961-1977	Stk.	82½
Wadkin, Ltd.	Ord.	10/-	25/-
Ward (Thos. W.), Ltd.	Ord.	£1	79/6
" "	5% Cum. 1st Pref.	£1	14/-
" "	5% Cum. 2nd Pref.	£1	22/6
Willson Lathes, Ltd.	Ord.	1/-	3/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

Extra work holding collets, up to ½in. diameter capacity, fit directly into spindle bore. Optional Extras: 3-jaw 3½ inches diameter precision self-centring, and 4-jaw independent chucks.

Extra equipment is "live" spindle swivelling workhead which plugs in. Features include: rapid changeover from standard, large spindle flange, reversing switch for face grinding, 12 spindle speeds 65 to 670 r.p.m.

Myford MG12 GRINDING MACHINE



Circulating pump and ample oil reservoir ensures constant lubrication of 'Myford' cartridge - type wheel spindle unit. Spindle is of nitralloy steel. Easily replaced.

Electrically regulated work speed for "dead or alive" workspindle, with two ranges of six speeds. Range selected by V-belt transfer, speed by selector switch.

Optional Extra: removable internal attachment for mounting on wheelhead front. Grinding diameter 0.25 to 3 in. (6.5 to 75mm) depths to 3 in. (75mm).

Wheelfeed dial indexed to 0.0001 in., plus graduated thimble to give micrometer control of infeed to 0.000025 in. Dead stop for repetition work. Hardened feed screw, ground thread.

Please write for further information to:

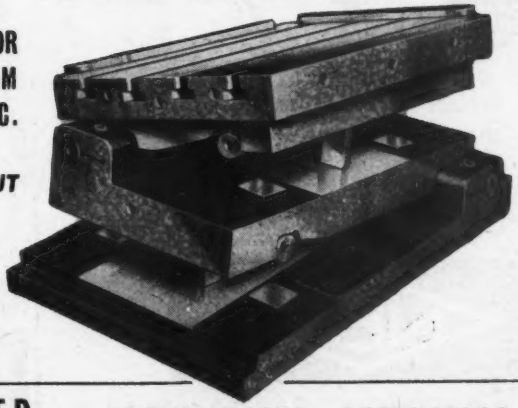
Myford MACHINE TOOLS

Myford ENGINEERING CO LTD
BEESTON NOTTINGHAM
TEL NOTTINGHAM 25-4222

P5074

CROWN WORKS "Composine" COMPOUND SINE TABLE

...FOR THE GRINDING OF SINGLE OR COMPOUND ANGLES, TOOL ROOM INSPECTION, JIG BORING ETC.



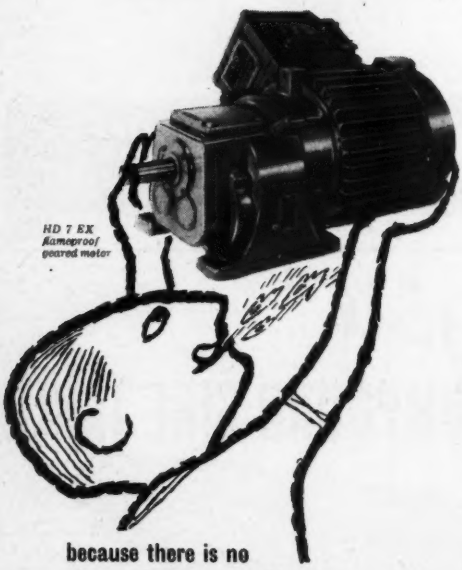
A PRECISION JOB THROUGHOUT
WITH 5" AND 10" ROLLER CENTRES
SIZE: Table 11½" x 8"
Height when flat 5½"

N.P.L. Certificate to 0·2 minutes supplied, if required, at extra cost.

MANUFACTURED BY

WINDLEY BROS. LTD. CROWN WORKS, CHELMSFORD.
Telephone CHELMSFORD 2224

FEARLESS FIRE-EATERS RELISH NECO FLAMEPROOF GEARED MOTORS



HD 7 EX flameproof geared motor

because there is no chance of them causing heart-burn — up to 200 lb. ft. ¼ to 2 h.p.

FLP

NECO

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MAGNAL

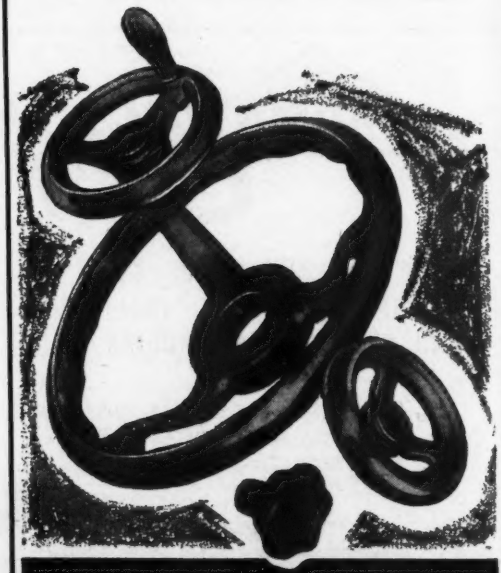
Aluminium Alloy

HANDWHEELS

- Range of sizes: 2in. 3¼in., 5in., 6in., 6¾in., 7in., 9in., 10in. (dias.).
- Supplies ex-stock (un-machined boss).
- Supplied WITH or WITHOUT Standard Pattern Handle (5in., 7in., 10in. sizes only).
- Outer circumference and handle machined and polished (except 2in. size).
- Handwheels can be supplied with boss un-machined or machined to customer's requirements.
- Any quantity supplied.

Send for our Brochure—detailing prices and maximum dimensions for machining.

★ We can also supply you with your Gravity and Pressure Diecastings.



MAGNAL PRODUCTS LTD
YATE BRISTOL
Tel: CHIPPING SODBURY 2001 (8 lines) Grams: MAGNAL YATE

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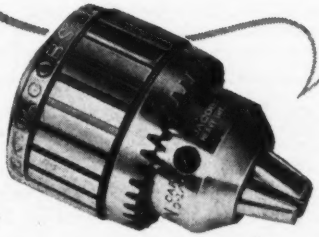
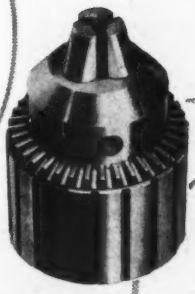
" I'm not talking out of the back of my head "





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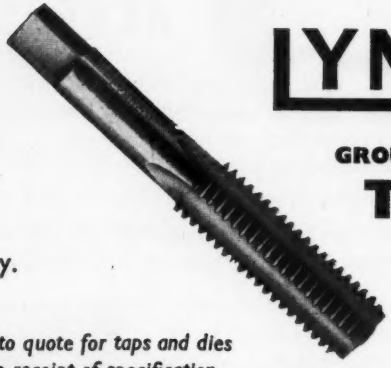

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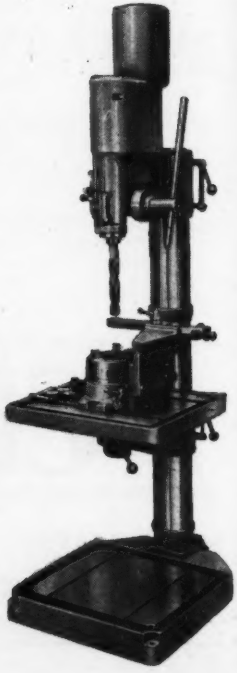

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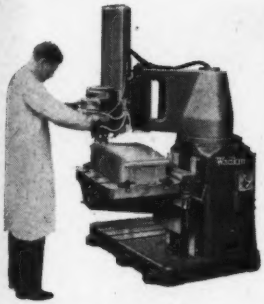
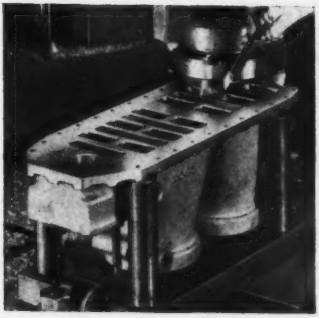
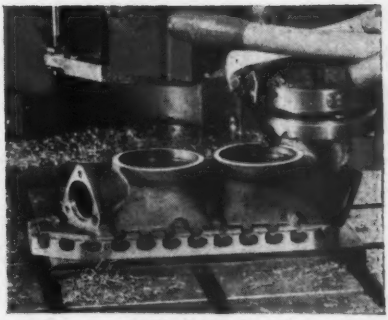


Wadkin Articulated Arm Router L.C.6.





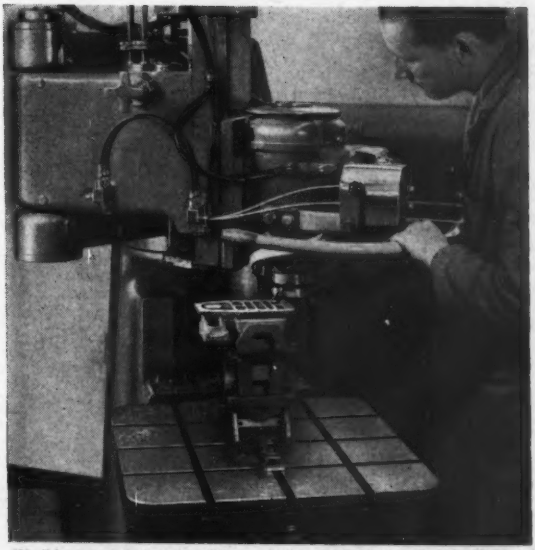
Face-milling Valve Body components on a Wadkin type L.C.6.

Wadkin Articulated Arm Router

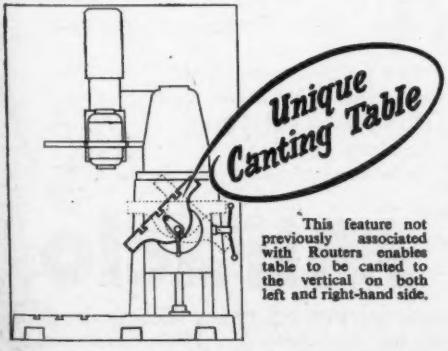
cuts machining times by more than 50%

on light alloy components

D. Merrett & Co. Ltd., Tewkesbury are yet another firm who have taken advantage of the new Wadkin High-speed Milling Techniques.
Their Wadkin Articulated Arm Router, type L.C.6, recently installed to meet rising production costs, has cut machining times by more than one half! Type L.C.6 is a relatively inexpensive, medium capacity machine with cutting speeds up to 18,000 r.p.m. It has power rise and fall to the head. integral base plate, and rising and falling canting table. Details of the L.C.6 and the Heavy Duty Machine, type L.C. with either 6ft. 0in. or 8ft. 0in. reach are given in Leaflet 945. May we send you a copy?



Wadkin type L.C.6, face-milling a Valve Body Outlet, for Teddington Aircraft Controls Limited, at D. Merrett & Co. Ltd., of Tewkesbury.



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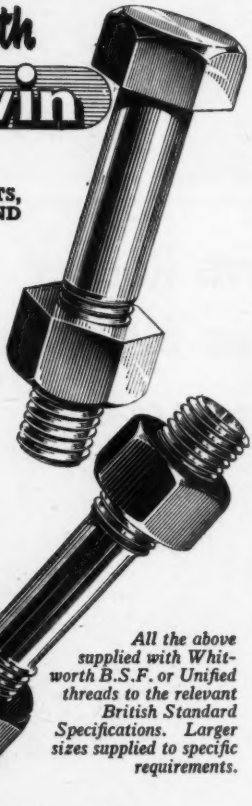

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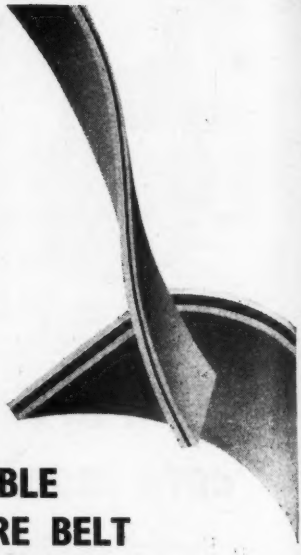

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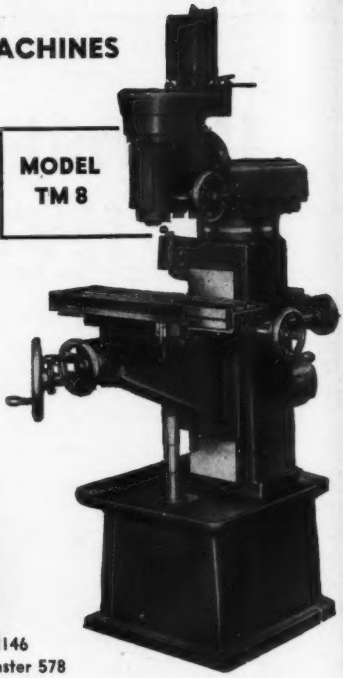

STANDARD MILLS

Model	Table	Table to Spindle
1	22" x 6½"	16"
2	28" x 6½"	16"
3	28" x 8"	15"
4	28" x 8"	19"
5	28" x 10"	19"

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Radial and Sliding Arm, Swivelling and Down Feed Head. Power Feed to table optional.

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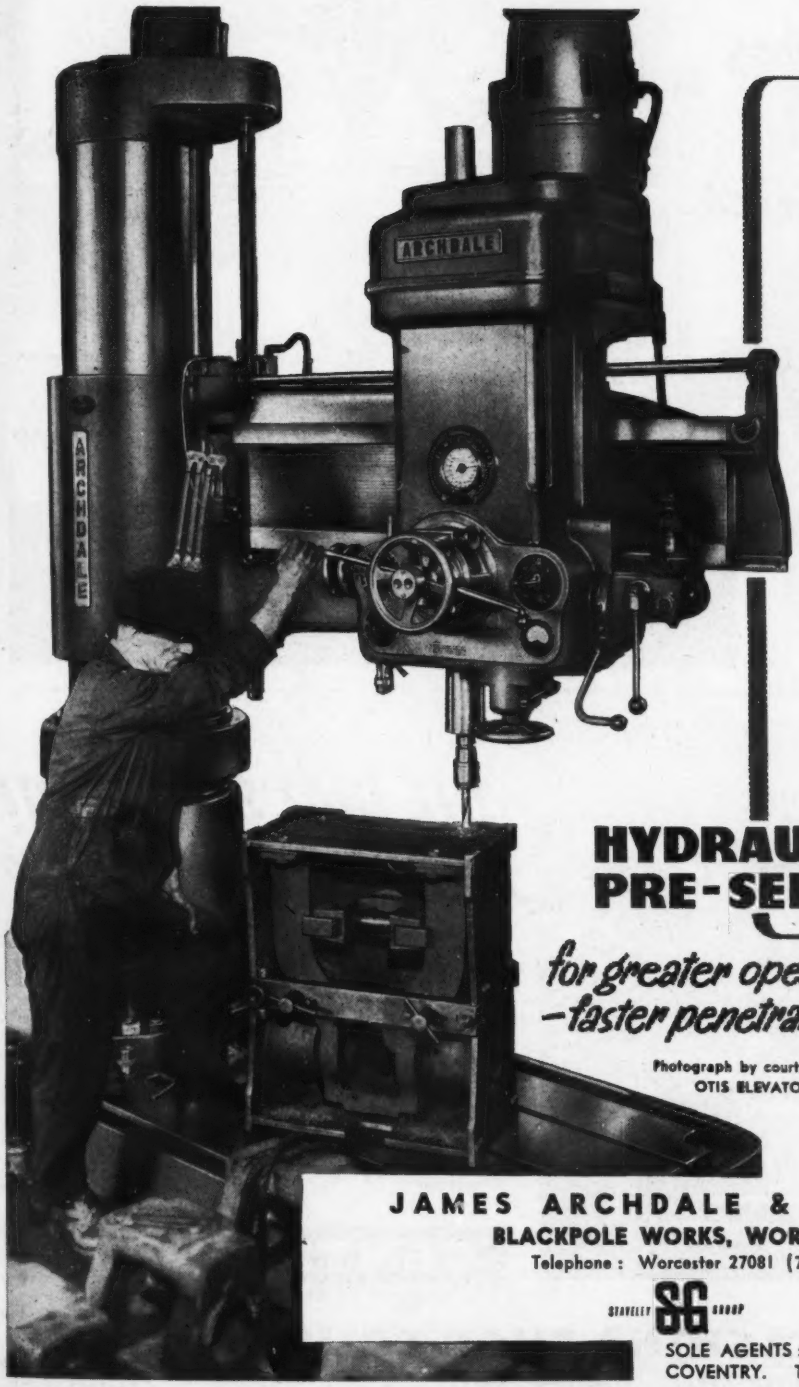

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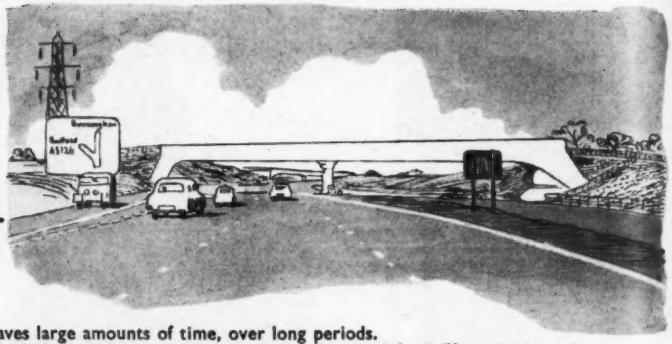

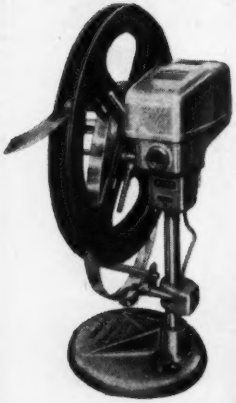

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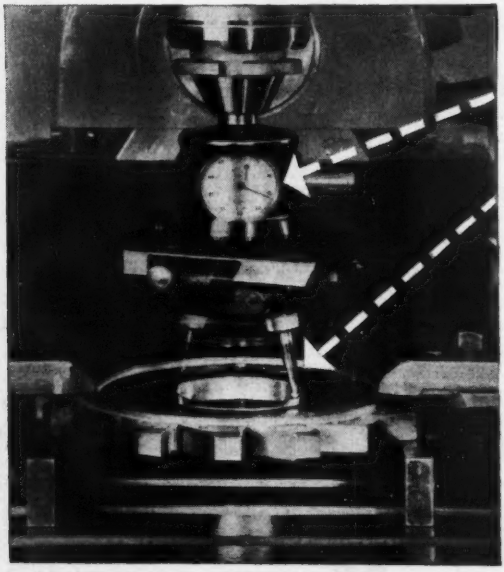

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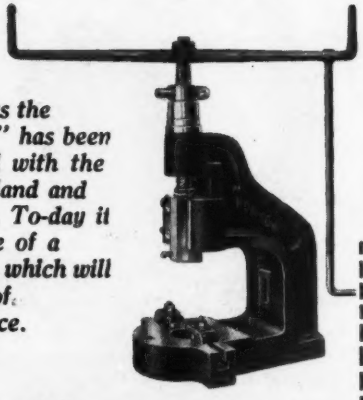

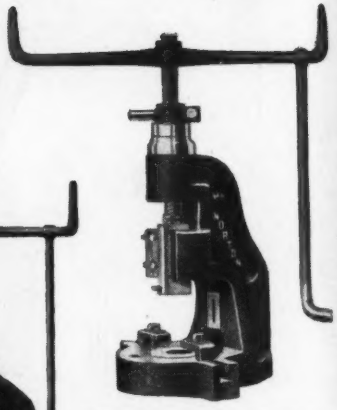

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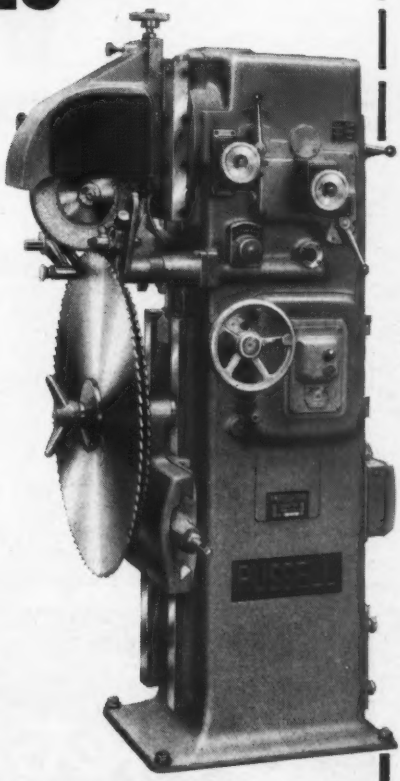

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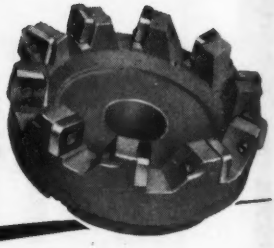

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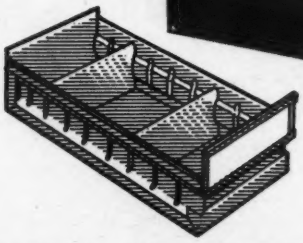

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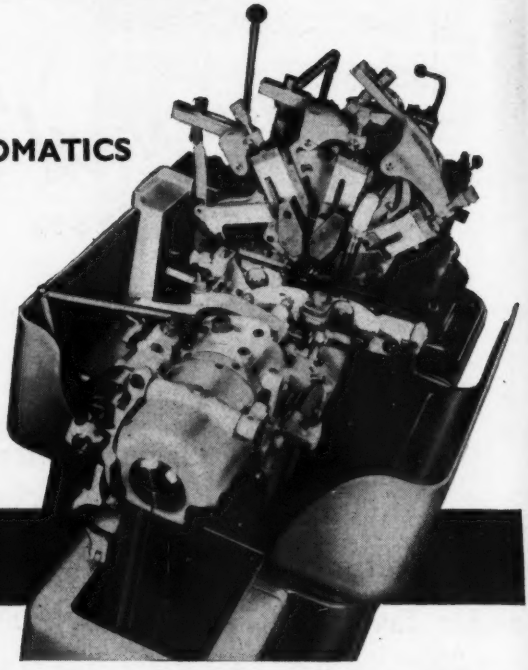

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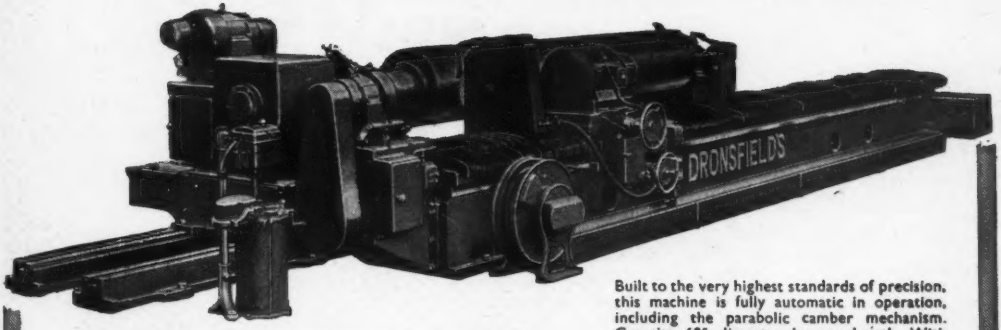

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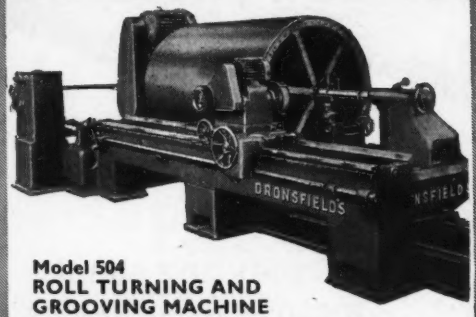

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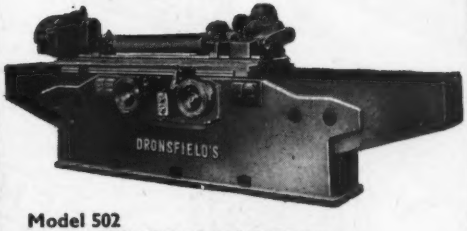

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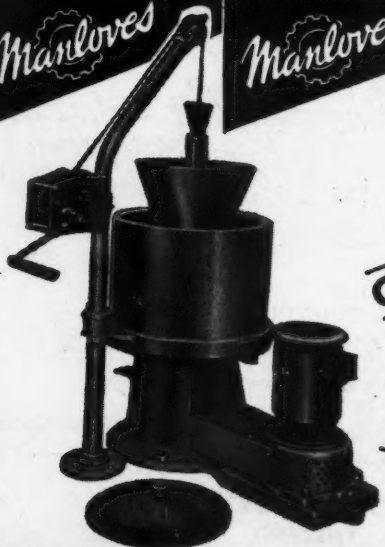

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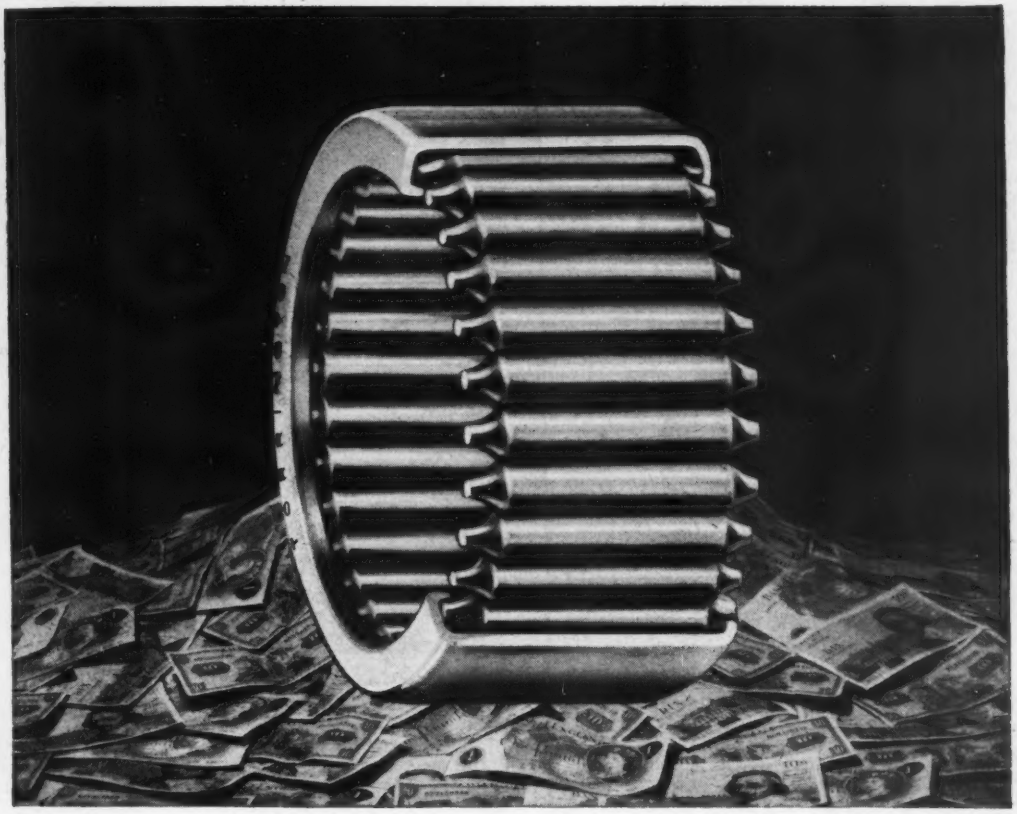

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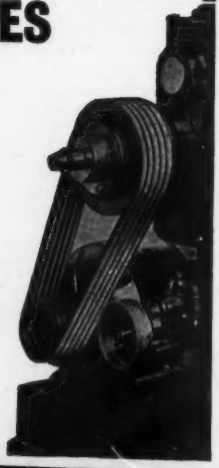

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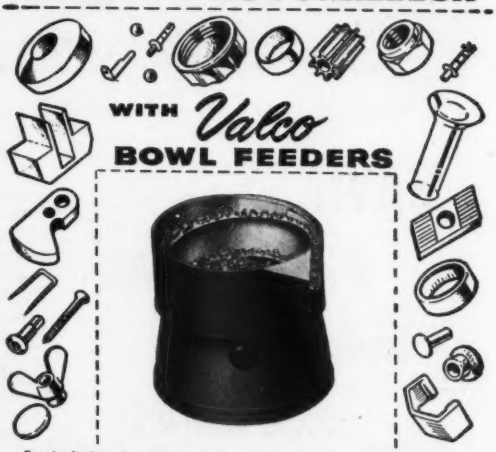

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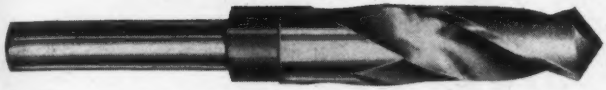

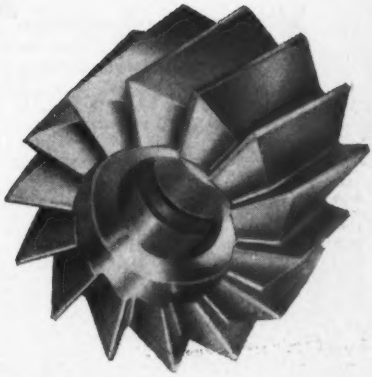

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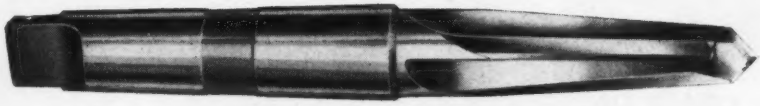

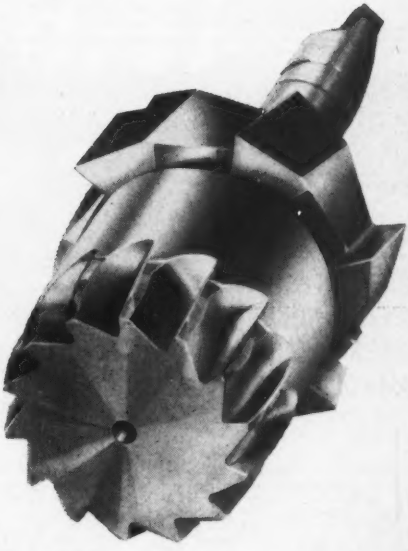

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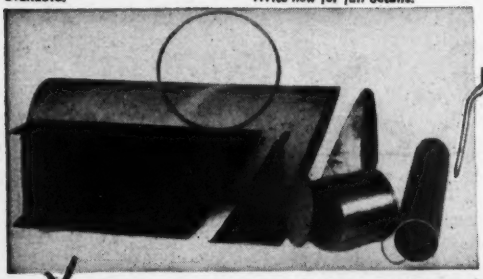

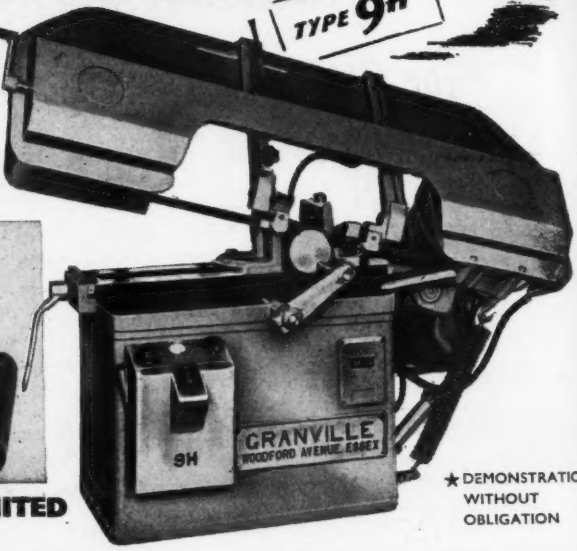

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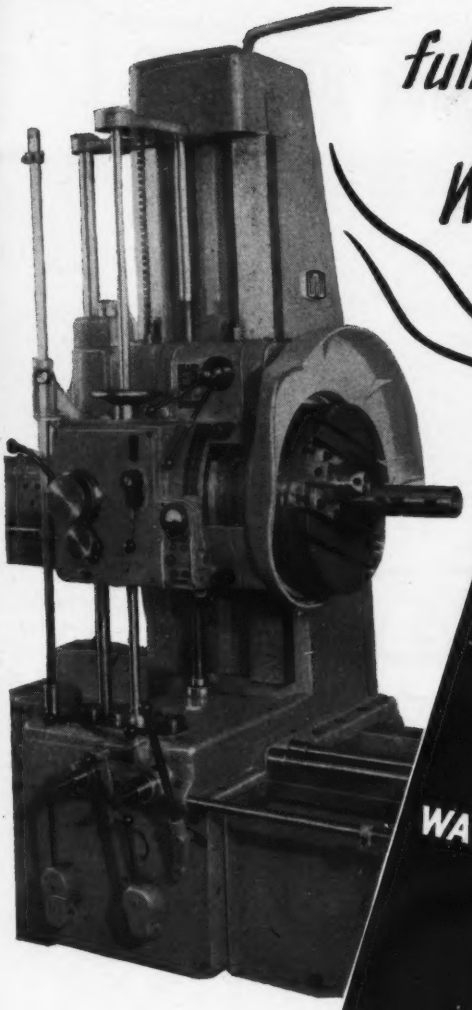

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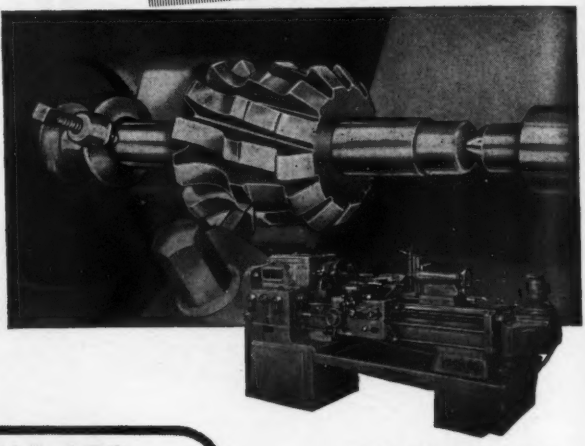

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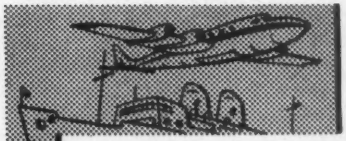

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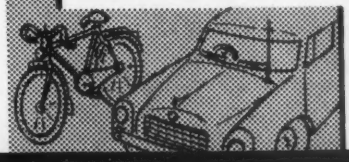

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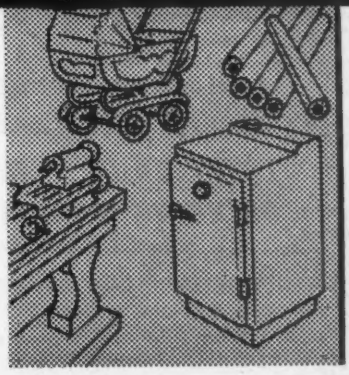

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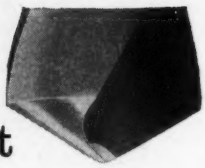

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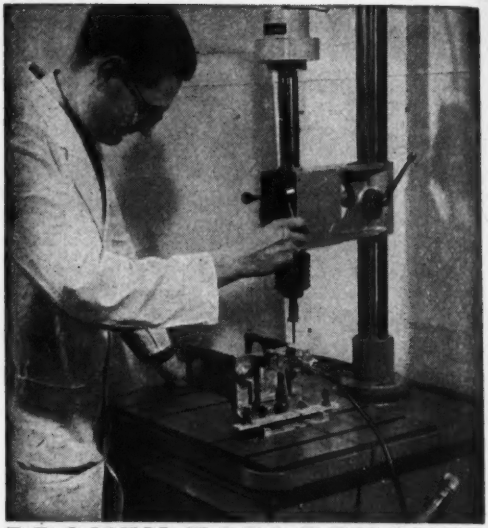

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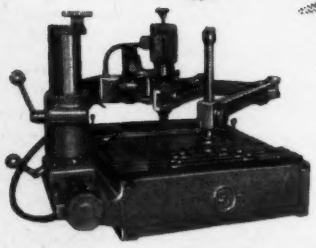

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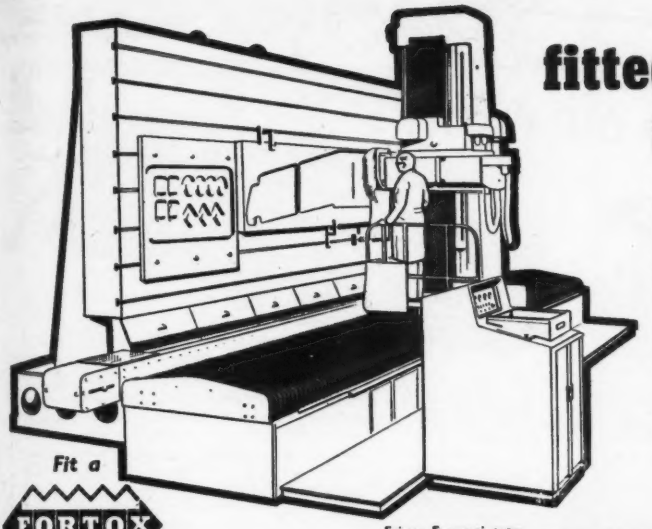

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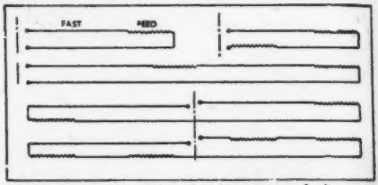

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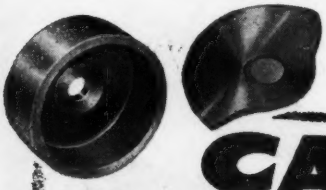

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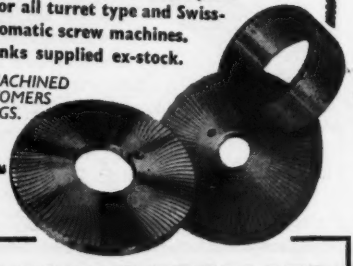

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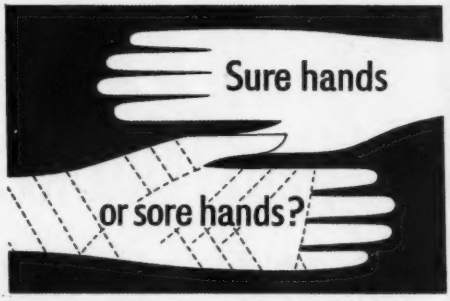

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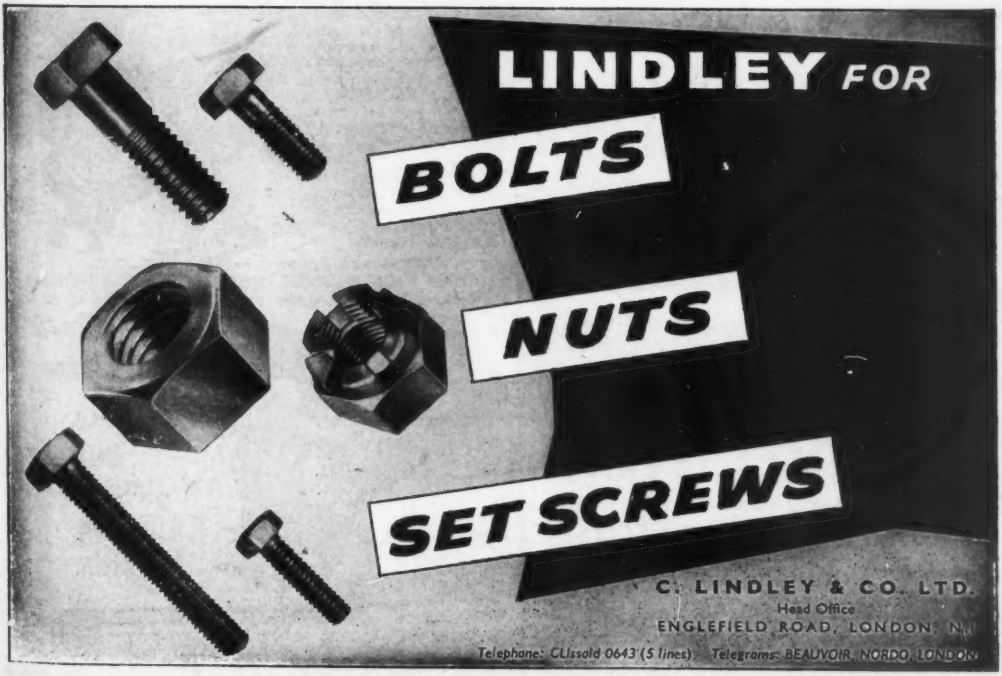

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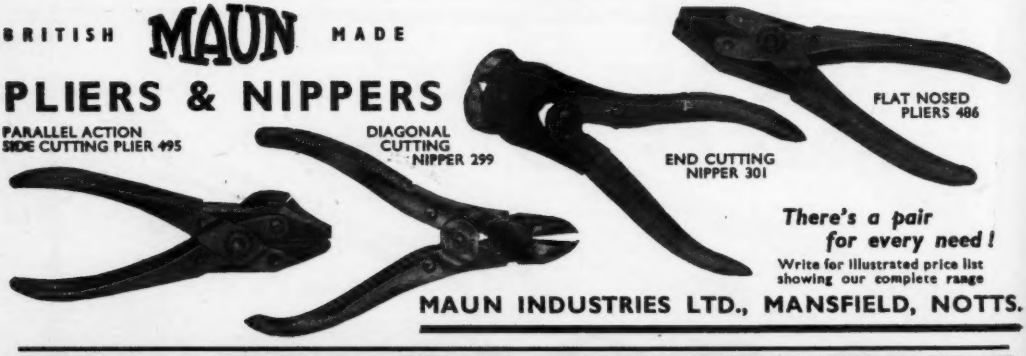

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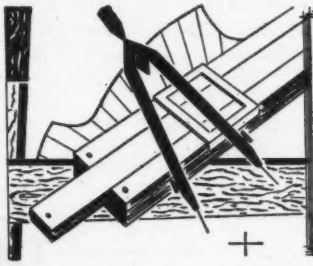

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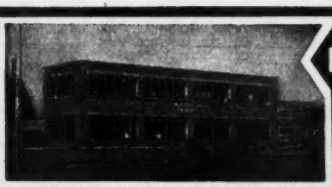

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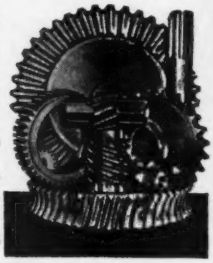

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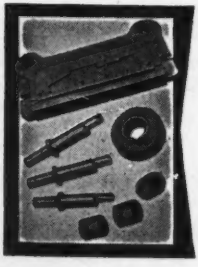

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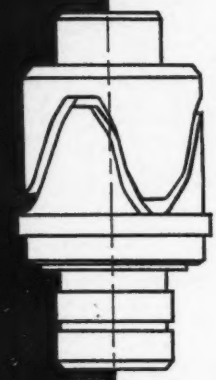

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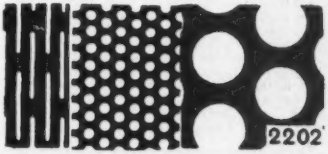

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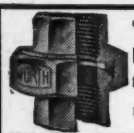

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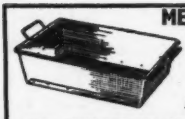

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RHODES Press Brake, 8ft. × ¼in., Motorised, Undercranked.
RHODES Guillotine, 8ft. × ¼in., Motorised.
RHODES Multi Punching Machine, Single Pulley Drive, 5ft. capacity.
RHODES Multi Punching Machine, 10ft. capacity, Undercranked, Motorised.
RHODES Bending and Folding Machine, 5ft. × ¼in., Single Pulley Drive.
EDWARDS Bending and Folding Machine, Motorised, 5ft. × ¼in.
RHODES Multi Punching Machine, Motorised, 5ft. capacity.
RHODES Bending and Folding Machine, 4ft. × ¼in. capacity, Single Pulley Drive.
RHODES Bending and Folding Machine, 4ft. × ¼in. capacity, Single Pulley Drive.
RHODES Multi Punching Machine, Single Pulley Drive, 5ft. capacity.
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POWER GUILLOTINE, 7ft. 6in., 14s. Gauge.
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SPRINGFIELD 14in. Swing F. & B. Lathe. £225

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CINCINNATI 2MH., 53in. × 11in.
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ADCOCK & SHIPLEY 1VM Vert. 25in. × 7in. As new.
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TWO **BLISS** No. 18 size Inclinable Power Presses. Pressure exerted approx. 8 tons. Stroke 2in. Bed 14½in. × 9in. Hole in bed 6¾in. diameter. Opening through back 7in. Weight approx. 8 cwt.

BESCO No. 18 size Inclinable Power Press. Pressure exerted approx. 12 tons. Stroke 1¼in. Opening through back 8in. Bed 15in. × 9in. Hole in bed 6¼in. × 4¼in. Weight approx. 9 cwt.

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Corona Heavy Duty Vertical Drilling machine. No. 5 Morse Taper. Excellent condition.

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ACME GRIDLEY 2¼in. 4 spindle Automatic. Collets, stockreel stand and motors 400/3/50. Good condition. 1944.

NEW BRITAIN 61 2¼in. 6 spindle Automatic. Stockreel stand chip conveyor or threading spindle, collets. 1942. Motorised.

CONOMATIC 1¼in. 8 spindle Automatic. Collets, stockreel, screwing spindle.

B.S.A.-ACME GRIDLEY ¾in. 4 spindle Automatic, with threading and high speed drilling attachments. Flange motor drive.

ACME GRIDLEY RA6 1in. 6 spindle Automatic. 1942. Universal threading spindle, chip conveyor, high speed drilling, cams and collets, 400/3/50 motors.

NEW BRITAIN 61 1¼in. 6 spindle Automatic. Screw machine with chip conveyor, 400/3/50. 1943.

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All machines carefully maintained and guaranteed in good running order.—BOX C899, MACHINERY, Clifton House, Euston Road, N.W.1.

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SWIFT Lathe, 15in. × 22ft. 6in.
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RHODES 6ft. × ¼in. Guillotine.
FACEPLATE LATHE, 80in. swing.
RICHARDS No. 1 and 4 Horiz. Borers.
RICHARDS 5ft. Double Column Vert. Borer.

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Classified Advertisements (*PLANT FOR SALE, contd.*)

Newman

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BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle.

BORING MACHINES

KEARNS Model OC Horizontal Boring Machine, 3in. dia. travelling spindle.
ROCCO Model AL55D Horizontal Boring and Facing Machine, 2½in. dia travelling spindle. (NEW.)
KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. dia. travelling spindle, with extended traverse.
KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.
GIDDINGS & LEWIS No. 45 Horizontal Boring, Machine, 5in. diameter travelling spindle.

CAPSTAN AND CENTRE LATHES

CHURCHILL REDMAN Model 13 NM Heavy Duty S.S. & S.C. Gap Bed Centre Lathe, 13in. centre height × 72in. between centres. Swing in gap 50in.
MITCHELL Model DM10 S.S. & S.C. Gap Bed Centre Lathe, 10½in. centre height × 7ft. 5in. between centres. (NEW.)
OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10½in. centre height.
WARD 7B Combination Turret Lathe.
HERBERT No. 12 Combination Turret Lathe, 6½in. diameter hollow spindle.
NILES Heavy Duty Centre Lathe, S.S. & S.C., 17in. centre height × 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height × 30ft. between centres.

DRILLING MACHINES

HETTNER Radial Drilling Machine, 10ft. elevating arm.
TOWN 30in. Single Spindle Boring and Drilling Machine.

GEAR MACHINES

ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

LANDIS Type C Plain Hydraulic Cylindrical Grinding Machine, 6in. swing × 18in. between centres.
LANDIS Plain Hydraulic Cylindrical Grinding Machine, 18in. swing × 72in. between centres.
ORCUTT Model HM24 Internal Spur Gear Grinding Machines.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing × 72in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing × 36in. between centres.

MILLING MACHINES

CINCINNATI No. 3 High Speed Dial Type Vertical Milling Machine (1950).
CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 91in. × 22in. (1952).
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
CINCINNATI No. 1M Vertical Milling Machine.
CINCINNATI No. 4 Dial Type Horizontal Milling Machine.
GRAFFENSTADEN Model F1101 Plain Horizontal Milling Machine, table 52in. × 10in.
PRATT & WHITNEY Model BL3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

MISCELLANEOUS

RUSSEL Model 26/28 Hydrofeed Cold Sawing Machine.
LANGE & GAILEN 28in. stroke Double Headed Hydraulic Shaping Machine.
TAYLOR & CHALLEN Double Sided 50-ton Geared Power Press, 10in. stroke.

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C.V.A. No. 26. 1960 Machine.
C.V.A. No. 12. 1960 Machine.
C.V.A. No. 8. 1950.
B.S.A. ¾in.

LATHES

Broadbent 14in. × 7ft., unused.
Sicmatic 14in. × 27in. Hyd. Lathe. 1960.
D.S. & G. 18in. × 12ft. S. & S.
Betts Bridgeford 15in. × 18ft.
Lang 6½in. × 3ft. S.S. & S.C.
Holbrook 6½in. × 4ft. Gap bed.

MILLING MACHINES

Sant Andrea U.F.O.3 Hor.
57in. × 14in., as new.
Archdale 20in. Hor. Rapid.
Reinecker Vert. 52in. × 24in. with built in cir. table, 30in.
Jason Vert. 48in. × 12in. Sw. and Sl.
Herbert 15s Vert. 48in. × 12in.
Adams No. 5 Thread Mill.

CAPSTANS AND TURRETS

Minganti 1a Turret, 2½in. Bar.
Gisholt No. 3 Capstan.
Warner & Swasey No. 3 Capstan.
Ward No. 2a Capstan Lathe.
Herbert 1S Capstan Lathe.
Murad 3Q Capstan Lathe.

MISCELLANEOUS

Churchill NB 18in. × 6in. Surface Grinder
B. & S. No. 2 Surface Grinder.
Excel No. 1 Surface Grinder.
C.V.A. 10 Die Press.
Maiden Bar-ending Machine.
Raboma 4ft. 6in. Radial Drill.
K. & W. 2in. Pillar Drill.
Granor 26in. H.D. Shaper.
Hutto Vert. Honer.
3 Ton Hi-ton Press.
S. Platt 3in. × 14g. Tube Roller.
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Morris 1 Ton Trolley Type Hand Crane. 13ft. under hook.—HICKS MACHINERY, LTD., 26 Addison Place, London, W.11. Tel.: PARk 2333.

Gisholt IL Combination Turret Lathe, A.G. Head, 3in. hole in spindle. Swing over saddle 16in. Max. turn off saddle 35in. 7.5 h.p. motor. Electrics 400/3/50. With equipment. Excellent condition.—BOX C552, MACHINERY, Clifton House, Euston Road, N.W.1.

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G.S.P. 9ft. Radial Drilling Machine, spindle traversing, No. 6 morse taper, speeds 8-1,725 r.p.m. As new.
HERBERT 7ft. Radial Drilling, Tapping and Boring Machine, spindle No. 5 M.T., 20in. dia. column. Weight approx. 8 tons.
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TOWN 4ft. 6in. Radial Drilling and Tapping Machine, Model AE4, No. 5 M.T. (New.)
CINCINNATI BICKFORD 36in. Radial Drilling Machine, spindle No. 4 M.T.
SEGIC (Swedish) 17in. Radial Drilling Machine, 1¼in. capacity, speeds 80-890 r.p.m. (New.)
LELAND GIFFORD 3-spindle Drilling Machine mounted on 4-spindle base, spindles No. 3 M.T. one spindle with power feed, pole change motors, 8 spindle speeds 165-1,500 r.p.m.
ARCHDALE No. 2240 28in. Production Type Drilling Machines, capacity in mild steel 3in. dia.
HERBERT Type C Pedestal Drilling Machine, No. 3 M.T., 230 volts, single phase, Auto spindle feed, flange mounted motor.

ENGRAVING MACHINES

TAYLOR, TAYLOR & HOBSON Model D Engraving Machines. (New.)
TAYLOR, TAYLOR & HOBSON Model A Bench Engraving Machine. (New.)
T.M.A. Model G2 Engraving Machine, pantograph reduction 1 : 1-7 : 1.

FILING AND SAWING MACHINES

WELLS Horizontal Bandsawing Machine, 16in × 5in. capacity.
GROB Model A3 Band Filing Machine, table 23in. × 17in.
RAPIDOR motorised Filing and Sawing Machine table 15in. × 15in.

GEAR CUTTING MACHINES

CHURCHILL-CLEVELAND Model 120 Rigid-hobber. Capacity 6in. dia. × 9in. face, 3 d.p.
BARBER COLMAN 12in. Gear Hobber.
FELLOWS No. 645A3 Gear Shaper, capacity 18in. × 3in. for spurs and helical gears.

GENERAL LATHES

BETTS-BRIDGEFORD 30in. swing × 22ft. Lathes, 16ft. between centres.
OLDFIELD & SCHOFIELD 21in. centre × 15ft. Gap Bed Lathe, 6ft. between centres, 4½in. hollow spindle, 62in. swing in gap.
COLCHESTER TRIUMPH 7in. × 6ft. 6in. Gap Bed Lathe, 4ft. between centres.
WILLSON 7½in. × 6ft. Gap Bed Lathe, 3ft. between centres.
BERRY 9½in. × 8ft. Lathe, 4ft. between centres.
SOUTHBEND 7½in. × 5ft. Lathe, 2ft. between centres.
DEAN, SMITH & GRACE 6½in. centre 13Z Lathe.
LANG Junior 6½in. × 6ft. Lathe, 30in. between centres.
LANG 24in. Surfacing and Boring Lathe.
LE BLOND 10in. Rapid Production Lathe, 7ft. between centres, 1¾in. hollow spindle, speed 45-300 r.p.m.
CROMWELL 3½in. × 40in. Lathe, stepless speeds to 2,000 r.p.m.

GRINDING MACHINES

MATRIX No. 1A Universal Grinder, 8in. × 24in.
CHURCHILL 16in. × 50in. Universal Tool and Cutter Grinder.
CHURCHILL 12in. × 36in. Hydraulic Universal Grinding Machine, with internal spindle.
BROWN & SHARPE 12in. × 30in. Universal Grinding Machine.
CHURCHILL 18in. × 6in. Model O Universal Tool and Cutter Grinding Machine.
CHURCHILL 8in. × 16in. Model O Semi-Universal Grinding Machine.
BILLETER twin head Radial Arm Open Sided Hydraulic Slideway Grinder. Table 9ft. 8in. × 2ft. 3in., infinitely variable table speeds 6ft. 6in. to 38ft. per min., push button control, rapid traverses, telescopic bed covers.
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CHURCHILL 24in. × 6in. Horizontal Spindle Surface Grinding Machine.
SNOW type NC14 Horizontal Surface Grinding Machine, 12ft. stroke, with canting table for shear blades, etc., fitted with 12ft. 6in. × 8in. magnetic chuck.

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KITCHEN & WADE Vertical Fine Boring Machine. 14in. stroke. Compound table.

SCHIESS Vertical Boring Mill, 39in. dia. of table. Maximum swing 48in. S.C.M.D. 35 h.p., 400/3/50.

GRINDING MACHINES

HEALD No. 172 Gap Bed Internal Grinding Machine, maximum diameter of component 36in.

BILLETER Hydraulic Open-side Slideway Grinding Machine, capacity 47in. × 12in.

LATHES

NOBLE & LUND Heavy Duty Centre Lathe, 22in. centre height × 29ft. between centres. Max. swing over saddle 33in. dia.

HARVEY Heavy Duty Centre Lathe, 42½in. centre height × 52ft. between centres. Max. swing over saddles 65in. dia.

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CRAVEN S.S. & S.C. Centre Lathe, 13½in. centre height × 31ft. 6in. between centres.

HERBERT No. 11 Combination Turret Lathe.

MILLING MACHINE

COLLET & ENGLEHARDT Keller Type Die Sinking Machine. Model FKf80, capacity 60in × 30in.

PLANING MACHINES

CLEVELAND Openside Planing Machine, capacity 10ft. × 2ft. 6in.

CINCINNATI Planing Machine, capacity 8ft. × 2ft. 6in.

MISCELLANEOUS MACHINES

CLIFTON & BAIRD Horizontal Cold Sawing Machine, 30in. dia. Saw. Maximum capacity 22in. × 7in. R.S.J.

BUTLER 18in. Stroke Slotting Machine

Hydraulic Vertical Internal Honing Machine (manufactured by PETER WOLTERS), Capacity 0.2in. to 2in.

RAPIDAN Double Helical Gear Generating Machine, 12in diameter capacity.

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SUNDERLAND No. 16 Gear Planer for spur and spiral gears, motor drive, fully equipped and ready for work, capacity 32in. dia. × 6in. face × 3 D.P.

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JONES & SHIPMAN 816, ⅞in. cap.
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HUPFIELD Router.
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RAPIDOR 6in. Hacksaw.
RAPIDOR Filing.

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Sheet Edging, 30in. × 22g.

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LUMSDEN Vert. 210 XXM.
SNOW Table, 20in.
ABRASIVE No. 34 Vertical Spindle.
ABRASIVE 3B, 24in. × 8in.
ABRASIVE No. 1¼in. hand.

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BRYANT 16138 and 5.

GRINDERS (Cylindrical)
CHURCHILL 6 × 36in. B.Y.
CHURCHILL PBH 12 × 36in. Uni.
NEWALL 6 × 18. Model XL.
FRANCIS 6 × 7.
PRECIMAX MPB 10 × 48.

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STEDALL WUNDERLI Carbide.
TAUCO 10in. Abrasive Cut Off.
ROWLAND 12in. × 2in. Single Wheel.
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WICKMAN NIVEN Carbide.
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DELAPENA 4 speed.

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LE BLOND Production.
RIVET S.S. & S.C. 4in. Model 602.
SOUTHBEND 10in. Toolroom.
WILLSON 7½in. S.S. & S.C.
COLCHESTER TRIUMPH 7in. S.S. & S.C.
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MONARCH 10EE × 22in. S.S. & S.C.
SMALLPIECE 9SW Multi-tool.
LORCH A11 Precision.
RIVETT 3½in. Plain. Model 715.
WARD, HAGGAS & SMITH 8½in. × 78in.
COULTHURST Surfacing and Boring.
RYDERMATIC No. 12 Multi Tool.
BERRY 6½in. S.S. & S.C.

MARKING MACHINE
FUNDITOR " Sand Jet."

MILLERS (Horizontal)
CINCINNATI 1/18 Production.
DENBIGH Type C4. Table 46 × 10.
ROSCHER EICHLER. Table 39in. × 12in.
SUNDSTRAND No. 0 Production.
ST. ANDREA Model UFO3. Table 57 × 14.
KENT OWEN 1/8 and 1/14 Production.
HARDINGE Precision. Table 25 × 6½.
WERNER. Table 14 × 5.
JONES 225 Univ. Table 22 × 6.
ARCHDALE 28in. and 20in.
RICHMOND O3. Table 40 × 10.
U.S. Multi Mill. Production.
PARKSON 2T Universal. Table 49 × 10.

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C.V.A. 79 Tool and Die.
PALLAS VI. Table 30 × 8½.
REED PRENTICE No. 5, 68in. × 16in. table.
MILNE. Table 30in. × 8in.
WADKIN Type LXIA. Table 36in. × 13in.

PRESSES (Power)
LECRA No. 8. 4 tons.
GERMAN Rotary Punch.
WRIGHT Clicking Press.
SCHULER VZZ. 15 tons d/s gripper feed.

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CURDNUBE 2 Spindle. Model KIV.

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ACE Horiz., ¼in. capacity.
HASKINS Type 3 C.A.M., ¼in. cap.
J. & S. Electrotap, ¼in.

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WICKMAN MOULTON.

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BROWN & SHARPE No. 13 Gear Cutting Machine.

DAVID BROWN MT30 Spur and Spiral Gear Hobbing Machine. Capacity 30in. dia. × 8in. face or 11¼in. dia. × 12½in. face, 3 D.P.

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BROWN & SHARPE No. 2 Surface Grinding Machine. Table 18in. × 6in.

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HERBERT No. 4 Capstan Lathe, bar feed, flamard bed, speeds up to 750 r.p.m., arranged for screwcutting.

WARD No. 7 Chucking Capstan Lathe. With covered bed, excellent equipment.

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MILWAUKEE Plain Horizontal Milling Machine. Table 63in. × 13in.

SOMUA FV48 Vertical Milling Machine, table 75in. × 16in.

CINCINNATI Model EA1-18 Plain Horizontal Milling Machine. Table 35½in. × 10in.

CINCINNATI HYDROMATIC 56-72 Hydraulic Plain Horizontal Production Milling Machine. Table 103in. × 26in. Speeds 24 to 179 r.p.m.

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CHURCHILL Hcy Internal Grinder.
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RAPIDOR 6in. Saw.

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ORCUTT 24in. Automatic Gear Grinder. New 1957.
LANG 26in. Boring and Facing Lathe.

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Landis 10in. × 24in. Type "C" Universal Grinder. Internal Attachment. New condition.

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Churchill 10in. × 24in. Universal Grinding Machine (1944). With steadies, etc. Reconditioned.—BOX C549, MACHINERY, Clifton House, Euston Road, N.W.1.

Landis 12in. × 36in. External/ Internal Grinding Machine with Excello Internal Spindle. Chucks and Steadies. Good condition. If interested telephone Mr. GANDER, Byfleet 43252.

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HEILBRONN 20 ton Open Front, All Steel.

HEILBRONN 30 ton Open Front, All Steel.

HEILBRONN 45 ton Open Front, All Steel.

PILOT 5-12-15 ton Hydraulic.

WORCESTER 3 and 6 ton Bench, Power.

SHEARING MACHINES

REPPEL Guillotine 8ft. by ¼in. Worm Drive.

APRESTA 8ft. by ¼in. O/Crank Guillotine.

KEETONA 6ft. 6in. by ¼in. and 8ft. by ¼in. All Steel Guillotines.

UNIVERSAL Power Punching and Shearing Machines. Cap. ¾in. and ¼in. Plate.

SILLA Nibbling and Shearing Machines ¼in.—⅜in.—½in. Cap.

FASTI Circle Shearing Machine 4in.—40in. by 16G.

FASTI Powered Circle Shearing Machine 6in.—40in. by 14G.

PILOT Hydraulic Cropping Machine.

VITTE Various Shearing and Punching Machines.

BENDING MACHINES

FASTI Bending Roll. 40in. by 16G.

FASTI Power Bending Roll. 40in. by ¼in.

FASTI Power Bending Roll. 6ft. 6in. by ¼in.

FASTI Folding Machine. 6ft. 6in. by 14G.

Stockists of all types of Presses and Sheet Metal Working Machines.

SHEET METAL MACHINERY COMPANY LIMITED
POYLE ROAD, COLNBROOK, SLOUGH, BUCKS.

Tel.: Colnbrook 2442/3/4

MIDLAND

BORING MACHINES

WEBSTER & BENNETT 4ft. D type Vertical Borer.

BANDSAWS

THIEL No. 17 Metal Bandsaw.

CROPPING MACHINES

Angle Cropping Machine. Cap. up to 6in. × ¾in. angles.

DRILLING MACHINES

POLLARD 13in. Pillar Drill. No. 2 Morse Taper. R & F. Table 11in. × 11in.

ARCHDALE 28in. H/Duty Pillar Drill. 4 Morse Taper.

GRINDING MACHINES

New **NORTON** 10in., 12in., 14in., 16in. and 20in. D/E. Tool Grinders.

ABRASIVE 3B 24in. × 8in. Vertical Spindle Surface Grinder.

CAPSTAN AND CENTRE LATHES

LANG 8¼in. × 4ft. 0in. S.S. & S.C. Lathe.

HAMMERS

MASSEY 5 cwt. Slide Type Pneumatic Hammer. 400/3/50.

MILLING MACHINES

RICHMOND H.2 Horiz. Miller. Table 35in. × 9in.

VAN NORMAN No. 26 Horizontal and Vertical Milling Machine. Slotting head.

MILWAUKEE 3.H Vertical Milling Machine.

PRESSES

BRADLEY & TURTON No. 3 Flypress.

SWEENEY & BLOCKSIDGE Bench Press. Cap. 3 tons.

SCREWING MACHINES

KENDALL & GENT 3in. Screwing Machine. Leadscrew Type.

POLISHING MACHINES

3 and 5 h.p. Polishing Spindles.

SLOTTING MACHINES

ORMEROD 12in. Stroke Slotting Machine.

All machines 400/3/50 electrics unless otherwise stated.

THE
MIDLAND MACHINE TOOL CO.
BRADLEY, BILSTON, STAFFS.
Tel.: Bilston 42471/9.

HELIOT

35 GREENWICH CHURCH ST, LONDON. S.E.10 GRE.1222

CAPSTAN LATHES

WARD 3A 1¼in. capacity, chucking, power feeds to turret.
WARD 3A 1¼in. capacity, chucking, power feeds to saddle and turret.

TURRET LATHES

WARD No. 16 covered bed, 8¼in. spindle. 32in. 4-jaw chuck, rapid and power feeds to saddle, cross slide and turret, power rotating turret, spindle speeds 7-225 r.p.m., 50-h.p. motor.
WARD No. 10/13 covered bed, 4¼in. spindle, ss.& sc., etc.
WARD No. 10 covered bed, 4¼in. spindle, ss.& sc., etc.
WARD No. 10B covered bed, 4¼in. spindle, power rotating turret, power and rapid feeds to turret only, collet head and bar feed.

DRILLING MACHINES

CORONA 3 spindle, 84-1,450 r.p.m. No. 3 Morse, pole change.
AVEY 2-spindle drill, pedestal base, ¾in. capacity.
ASQUITH O.D.I 5ft. Radial with loose box table.

HORIZONTAL MILLERS

SUNDSTRAND No. 2 Electro Mill. Auto cycle 12in. × 54in. table.
EDGWICK No. 2, 11in. × 42in. table, No. 40 steep taper.
JONES & SHIPMAN duplex slot miller, hydraulic feed.

VERTICAL MILLERS

WADKIN high speed for light alloy, 16in. × 40in. table.

GRINDING MACHINES

PRECIMAX M.P.H. 10in. × 36in. plain hydraulic cylindrical grinder.
LANDIS 10in. × 24in. universal hydraulic cylindrical grinder.
B.S.A.-LANDIS 6in. × 18in. plain hydraulic cylindrical grinder.
CHURCHILL HBB hydraulic internal grinder, autosizing.
CHURCHILL 35in. stroke hydraulic openside slideway grinder.
ABWOOD carbide tool grinder.
ROWLAND 18in. double-ended disc grinder.
BROWN & SHARPE No. 2 Surface Grinder, 18in. × 6in.

All machines motorised 400/3/50 unless otherwise stated.

No. 2 Wickman Horstman Thread Grinding Machine. Form relieving. Fully motorised.—BOX C738, MACHINERY, Clifton House, Euston Road, N.W.1

Bryant No. 24-36 Hydraulic Internal Grinder complete with Hydraulic Wheel Dressing device, Spindle, etc.
Further details from:—
C. & G. OLDFIELD, LTD.
15, Abercorn Street,
PAISLEY

GATE

MACHINERY CO., LTD.
176/178, Victoria Road, Acton, LONDON, W.3. ACOrn 8881

GRINDERS

BROWN & SHARPE No. 2 Surface Grinder.

STUDER Model PSM150 Profile Grinder. This machine is in excellent condition.

LANDIS Plain Cylindrical Grinder, 6in. × 18in.

HORSTMAN Thread Grinder, capacity 5in. dia. × 9in. B.C.

LATHES, CAPSTANS, AUTOMATICS

MEUSER 8¼in. Centre Lathe × 48in.

WARD 7 Combination Turret Lathe.

CARDIFF 7in. × 36in. between centres

Two **CLEVELAND** ⅞in. Model A Single Spindle Autos.

MEUSER Lathe, 8¼in. × 66in.

BOYES & EMMS S.S. & S.C. Lathe, centre height 16in. × 7ft. 6in.

HERBERT No. 20 Comb., spindle bore 7in., speeds 5-201.

ROLLO 6½ Centre Lathe.

HERBERT No. 9 Combination Turret Lathe.

SWIFT Hydraulic Copying Lathe, 36in. swing × 5ft. 6in. between centres, 30 h.p. drive.

MILLERS

ARCHDALE 48in. Heavy Duty Automatic Horizontal Mill, speeds 38-313.

CINCINNATI 1-18 Production Miller.

KENDALL & GENT Vertical Miller, table 69in. × 19in., speeds 20-300, rapid traverses.

ARCHDALE 28in. Horizontal Miller.

SACEM Vertical Miller, table 33½in. × 10in. Speeds 90-785 r.p.m. Traverses: long. 20½in. Spindle vertical 4in.

BROWN & SHARPE No. 2 Vertical Mill, table 54in. × 14in., speeds 30-1,200 r.p.m. Power down feed to head.

HURTH Single Head Keyseater, table 26in. × 9in.

SCHIESS DEFRIES Vertical Keyseater.

PRESSES, SHAPERS, PLANERS AND HOBBERS

CHURCHILL-REDMAN 32in. Stroke Heavy Duty Shaper. Excellent condition.

ESSEX No. 32 Punch Shaper.

30-ton **RASKIN** Double Sided Double Geared Drawing Press. Area 20in. × 23in. Draw 4¼in.

MAXICUT High Speed Gear Shaper, max. dia. 7in. × 2in. face.

New **POREBA** Model HDA.80 Planer, capacity 10ft. × 32in. × 30in. table, drive by Held gearbox.

DOWDING V8 Gear Hobber. Maximum pitch in steel one cut 14 D.P., in soft metals cut 12 D.P. Maximum dia. 0in.-8in. No. of teeth cut 6-400. Length of hobbing traverse 7¼in. Hob spindle speeds (10) 61-246 r.p.m.

Classified Advertisements (*PLANT FOR SALE, contd.*)

Cashmores

Selections of Machine Tools from Stock or Early Delivery

DRILLING MACHINES

New **TOWN** 4ft. 6in. AE1 Radial Drilling Machine.
KITCHEN & WADE 6ft. Girder Type Radial Drilling Machine, 18 spindle speeds, 6 feeds. No. 5 M.T. spindle, motorised 400/3/50 supply.
ARCHDALE Column Type Vertical Drilling Machine, compound table 27in. × 16in., No. 4 M.T. spindle. Motorised 400/3/50 supply.
ASQUITH Model O.D.1 6ft. Heavy Duty Radial Drilling and Tapping Machine. Motorised 400/3/50 cycles, with loose box drilling table.

BORING MACHINES

GRAHAM & NORMANTON Surfacing and Boring Lathe, swing 42in. dia. in gap, 18 spindle speeds 9/461 r.p.m., motorised 400/3/50 supply.
WEBSTER & BENNETT Series D 36in. Single Column Type Vertical Boring Mill, motorised 400/3/50 supply.

SLOTTING MACHINES

ORMEROD 12in. stroke Slotting Machine, 27in. dia. rotary table, motorised 400/3/50 supply.

LATHES

LANG 12½in. Gap Bed S.S. & S.C. Lathe, to admit 10ft. 6in. between centres.
CRAVEN 15in. S.S. & S.C. Lathe, to admit 25ft. between centres.
LANG 15in. Centre Lathe, two saddles, admit 17ft. 6in. between centres, motorised 400/3/50 supply.

MILLING MACHINES

C.V.A. "Kearney & Trecker" model 2E Dial Type Horizontal Plain Milling Machine, working surface of table 41in. × 12in., longitudinal feed 29in., cross feed 12in., 8 spindle speeds 25/1,000 r.p.m., motorised 400/3/50 supply.
CINCINNATI Model 3/36 Hydromatic Milling Machine, table 54in. × 14in., motorised 400/3/50 cycles.
MANN Vertical Milling Machine, with swivel head, dial change to spindle speeds and feeds, table 46in. × 12in., 9 speeds, 48/750 r.p.m., motorised 400/3/50 supply.
KENDALL & GENT CVM25 Vertical Miller, size of table 66in. × 19in., longitudinal feed 54in., 18 spindle speeds 15/840 r.p.m., motorised 400/3/50 supply.

BROACHING MACHINE

CINCINNATI 10 ton Vert. Single Ram Hydraulic Surface Broaching Machine, 66in. stroke 20in. × 20in. table, motorised 400/3/50 cycles

GRINDING MACHINES

JONES & SHIPMAN Fig. 540 Horizontal Spindle Hydraulic Surface Grinder, table 18in. × 6in., motorised 400/3/50 cycles.

POWER PRESSES

New **BUTTERLEY** B3½ Geared Open Fronted 75 Ton Power Press, 1in.-5in. adjustable stroke.
New **BUTTERLEY** No. 4, 20 Ton Ungeared Power Press, 1in.-3in. adjustable stroke.

SAWING MACHINES

NOBLE & LUND 40in./48in. Cold Circular Sawing Machine, 17in. diameter rounds, 15½in. squares, 27in. × 12½in. beams.
NOBLE & LUND 24in./28in. Cold Circular Sawing Machine, 10in. dia. rounds, 9in. squares, 18in. × 7in. beams, motorised 400/3/50 cycles.

SCREWING MACHINES

KENDALL & GENT 3-2 Tangential Head Screwing Machine, to screw bolts up to 2in. outside diameter, tubes up to 3in. inside diameter, machine fitted with leadscrew, motorised 400/3/50 supply.

SHEARING MACHINE

New **MORGAN** 6ft. × ¼in. Undercrank Guillotine Shearing Machine.

MISCELLANEOUS

CLYDE 10 ton Overhead Electric Travelling Crane, 52ft. 3in. span.

All the above machines are motorised 400-440/3/50 cycles.

JOHN CASHMORE LTD.,
GREAT BRIDGE, STAFFS. Tel.: Tipton 2181/7. (Also at **NEWPORT, MON.**)

NEW MACHINE TOOLS FROM STOCK

GRANOR OF HALIFAX 28in. stroke Heavy Duty Shaping Machine. 400-440/3/50.

EARLY DELIVERY

MITCHELL OF KEIGHLEY 8¼in. Type DM8 Gap Bed Lathe, by 5ft. 3in. B.C. 400-440/3/50. Instant delivery.
MITCHELL OF KEIGHLEY 10½in. Type DM10 Gap Bed Lathe by 5ft. 5in. between centres. 400-440/3/50. Instant delivery.
MITCHELL OF KEIGHLEY 12½in. Type DM12 Gap Bed Lathe by 6ft. 9in. B.C. 400-440/3/50. April delivery.
VICTORIA No. 2 Rapidmil Universal Milling Machine, table size 48in. × 11¼in. 400-440/3/50. Instant delivery.
VICTORIA No. V2 Vertical Milling Machine. Table size 45in. × 11in. 400-440/3/50. Instant delivery.

CENTAUR TOOL WORKS,
EYRE STREET, SPRING HILL, BIRMINGHAM, 18
Tel.: EDGbaston 1118 & 1119. 'Grams: Capstan, Birmingham

Kendall & Gent Screwing Machine, 1in. cap., 400/3/50. £250.—A. McNAMARA & CO., LTD., New Line, Bacup, Lancs. 'Phone: Bacup 946.

Reed Prentice No. 5 Vertical Milling Machine, Table 68in. × 16in. 18 Spindle Speeds 17-600 r.p.m. Excellent condition.—Further details from:—
C. & G. OLDFIELD, LTD.,
15. Abercorn Street,
PAISLEY.

Rapiradia Ali Annealing Oven. Temp. 400 deg. C. Gas-fired. Conveyor speed 25 i.p.m. Capacity 500 per hour. All tubes 1¾in. dia. × 6in. long.—BOX C706, MACHINERY, Clifton House, Euston Road, N.W.1.

Cleveland Gear Hobbing Machine, model 130. Max. dia. 8in. × 16in. between centres. Travel 8in. Machine constant 12. Max. hob dia. DP.4 in steel. Electrics 400/3/50. Drive 3 h.p. motor. Rapid traverse motor 1½ h.p.—ROLLS TOOLS, LTD., Pyrford Road, Pyrford, Woking, Surrey, or 'phone Byfleet 43252.

Cincinnati No. 2 Plain Horizontal Milling Machine, Dial type. Med. speed. Dual controls. 3-way Rapid Power Traverse.—BOX C702, MACHINERY, Clifton House, Euston Road, N.W.1.

15in. Centre "Dean, Smith & Grace" Type 4/9D m/d. all-gd. S.S. & S.C. Lathe with taper turning attachment. 11ft. box end gap bed. 5ft. 6in. b.c. 48in. dia. in gap. 5 h.p. 415/3/50 motor. 16 spindle speeds 9-180 r.p.m. Spindle bored 3⅜in. dia.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone 84246.

Hordern, Mason & Edwards L 20-ton, adj. Stroke, inclinable, motorised, guards, ex. cond. Edwards 28-ton column press, adj. stroke, adj. Table, Guards, mot. Ex. cond.—C. L. THOMAS, LTD., Stirling Road, Solihull. Tel. 3075-6.

D. S. & G. Surfacing and Boring Lathe, 24in swing, 400/3/50.—A. McNAMARA & CO., LTD., New Line, Bacup, Lancs. 'Phone: Bacup 946.

Huller UG3 Tapping Machine, 1955. 400/3/50.—BOX C902, MACHINERY, Clifton House, Euston Road, N.W.1.

Churchill H.B.A. Internal Grinder. Automatic hydraulic cycle. Faceplate speeds 98, 158, 238, 350 r.p.m. 12½in. faceplate. Max. hydraulic traverse 18in. variable feed. Motorised coolant system built-in. Fully motorised 400-440/3/50.—BOX C925, MACHINERY, Clifton House, Euston Road, N.W.1.

DOUGLAS OF HIGH WYCOMBE

SECONDHAND MACHINES FOR IMMEDIATE DELIVERY

LATHES

HALIFAX 5in. S.S. & S.C. Lathe. £110
HERBERT SMALLPIECE No. 9 W.S.L. Multicut Production Lathe. £345
HERBERT N.D. 8in. S.S. & S.C. Lathe. £190
LANG 8½in. S.S. & S.C. Lathe. £575
LANG 7in. High Speed Finishing Lathe. £450
MYFORD DRUMMOND 3½in. Lathe. £35
SOUTHBEND 4½in. Bench Lathe. £65
ZBROJOVKA 7½in. S.S. & S.C. Lathe. £1,200

GRINDING MACHINES

CHURCHILL Rotary Surface Grinder (12in. dia. rotary magnetic chuck). £420
EAGLE Surface Grinder, Model 2A (hand feeds). £170
JONES & SHIPMAN Portable Toolpost Grinder. £30
LUMSDEN Vertical Grinder, Size 91 (36in. rotary magnetic table). £750

MILLING MACHINES

CINCINNATI No. 3 Sliding Head Vertical. 63in. × 15in. table. £750
HERBERT 16V Sliding Head Vertical, 57in. × 13in. table. £275
MINGANTI FVM3 Sliding Head Vertical, 62in. × 15in. table. £1,425
MILWAUKEE No. 2 Horizontal, 50in. × 14in. table. £475
PARKSON 2P Plain Horizontal, 52in. × 12in. table. £400
VICTORIA JUNIORMIL Plain Horizontal, 28in. × 7in. table. £310
ADCOCK & SHIPLEY Thread Milling Machine, 4½in. dia. × 12in. cap. £100

PRESSES

No. 1 Fly Press. £7 10s.
No. 2 Fly Press. £13
BESCO Bench Power Press (unmotorised) (4 ton pressure). £40

SHAPING AND PLANING MACHINES

NEW ENGLAND 10in. Stroke Shaper. £70
BUTLER Planing Machine, 9ft. × 2ft. 6in. table. £1,100

ELECTRIC MOTORS

(all 400-440/3/50 cycles supply except where otherwise stated)

HOOVER ½ h.p.—¼in. dia. spindle. £4 10s.
HOPKINSON ½ h.p.—¾in. dia. spindle. £6 10s.
HUGH SCOTT 1 h.p.—¾in. dia. spindle. £7 10s.
ENGLISH ELECTRIC 2 h.p.—⅞in. dia. spindle. £9
BROCK 2 h.p.—1¼in. dia. spindle (single phase). £15
CROMPTON PARKINSON 3 h.p.—1in. dia. spindle. £12
HOWELLS 3 h.p.—1¼in. dia. spindle. £10
ENGLISH ELECTRIC 3 h.p.—1¼in. dia. spindle. £17 10s.
METROPOLITAN VICKERS 5 h.p.—1¼in. dia. spindle. £15
DYNAMO & MOTOR REPAIRS 5 h.p.—1in. dia. spindle. £15

THIS LIST DOES NOT INCLUDE THE MANY NEW MACHINES THAT ARE AT PRESENT IN OUR SHOWROOM AT HIGH WYCOMBE. WHY NOT VISIT US TO INSPECT OUR RANGE?

A. DOUGLAS CO., LTD.,
LINCOLN ROAD,
CRESSEX INDUSTRIAL ESTATE,
HIGH WYCOMBE, BUCKS.
Tel.: High Wycombe 4390 (5 lines).

RING BELLS *for machine tools*
LEEDS 63-7398

FRYE

COVENTRY Matrix 21 Thread Grinder.
ASQUITH 3¼in. Floor Borer, spindle speeds 5.6-350. Screw cutting 3-12 t.p.i.
CHURCHILL 20in. × 84 Plain Grinder with throw blocks for crankshaft grinding.
PROGRESS 4E Pillar Drill.
CINCINNATI Model EA, 18in. × 6in. Plain Grinder.
TRIDENT 18in. × 6in. Surface Grinder.
SCHUTTE Model WU4 20 × 6 capacity, hydraulic automatic feed to table.
JONES & SHIPMAN 4in. × 10in. Semi Universal Grinder.
RICHMOND MV1 Vertical Miller.
ADCOCK & SHIPLEY 2V Vertical Miller.
PEARN RICHARDS Horizontal Borer, 28in. dia. facing head rapid traverses and screw cutting.
SMART & BROWN 4in. Capstan.
150 ton 10ft. Press Brake, with Fraser Mono Radial. 30 h.p. pumping unit.
Two **TAVANNES** Single Spindle Automatics, Type M60. Bar capacity 2¼in. Max. turning length 8¼in. About 4 years old. Half new price.
KOLB KZ1 Spur and Helical Gear Grinder. Up to 12in. dia. As new.
ABRASIVE No. 3 Horizontal Spindle Surface Grinder, 24in. × 8in. capacity.
GISHOLT 3L Combination Turret Lathe, 4¼in. hollow spindle. 10 h.p. motor.
WICKMAN MOULTON ATM1 Thread Miller. Max. dia. milled 6in. external, 7¼in. internal. Distance work and cutter spindle 24in.
HULLER UG3 Radial Arm Tapper.
CHURCHILL 20in. Swing × 84in. Cylindrical Grinder.
7in. Power Hacksaw.

FRYE MACHINE TOOL CO. LTD.,
POYLE ROAD, COLNBROOK, BUCKS.
Telephone: Colnbrook 2442.

Archdale Snout Borer, Modern machine. Spindle dia. 5in. Table area 65in. × 19in. 7.5 h.p. Spindle nose 50 Int. taper. Rapid power approx. to work. Auto change-over to feed and run. Fast return electrically controlled.—BOX C770, MACHINERY, Clifton House, Euston Road, N.W.1.

No. 2 Edgwick Vertical Milling M/c., dial type. Table 46in. × 11in. Long. traverse 28in. Auto rotary table. Speeds 37-605 r.p.m. S.C. motor.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone 84246.

6in. RPA 8 Spindle Gridley Chucking Auto complete with Chucks, Cams, Tool Slide Holders, etc. Fully motorised. Excellent condition.
Further details from:—
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.

Butler 8in. Slotter, Capacity 8in. stroke, 20in. dia. table, electrics 400/3/50. Excellent condition.—BOX C846, MACHINERY, Clifton House, Euston Road, N.W.1.

ALBERT EDWARDS
(MACHINERY) LTD.,
79/89, PENTONVILLE ROAD,
LONDON, N.1.
Telephone: TERminus 0167/8/9.

CRAVEN 82 Rigid Plain Horizontal Milling Machine. Table 47in. × 15in.
SONDERMAN & STEIR 40in. Vertical Boring Machine. Table speeds to 135 r.p.m.
E.M.B. 15 ton Flexi-Press. 12in. stroke.
12¼in. Super **PROGRESS** Gap Bed Lathe. Admits 7ft. 9in. B.C. Speeds 30/1031 r.p.m.
ARCHDALE 28in. Milling Machine. General purpose.
All above machines are Motor drive, standard voltage.

Churchill H.B.B. Internal Grinder. 4 faceplate speeds 98-350 r.p.m. Max. faceplate swing 15in. 3 h.p. motor 400/3/50.—BOX C928, MACHINERY, Clifton House, Euston Road, N.W.1.

Gisholt No. 3 A.G.H. Turret Lathe. 2¼in. spindle bore, 1,460 r.p.m. Motor 400/3/50.—BOX C920, MACHINERY, Clifton House, Euston Road, N.W.1.

Herbert Carbicut Lathe. 16 spindle speeds 445 to 3,025 r.p.m. 3 feed changes 70, 105, 140. 1¼in. dia. spindle bore. 5 h.p. motor 400-440/3/50.—BOX C910, MACHINERY, Clifton House, Euston Road, N.W.1.

MISCELLANEOUS FOR SALE

Induction Heaters, for Brazing, heat treatment, etc., 1 kW rating. £150.—NU-GUN TELETUBES, LTD., 3, The Mews, Ducket Road, London, N.4. MOU. 2903.

AUCTIONS

By Order of the E R Secretary of State for War

Messrs.
FULLER HORSEY
Sons & Cassell
have been instructed to offer for SALE BY AUCTION in Lots at the **ROYAL ARSENAL, WOOLWICH, LONDON, S.E.18,** on **TUESDAY, 16th MAY, 1961,** and following days at 10.30 a.m. precisely each day.

ENGINEERS' MACHINE TOOLS INDUSTRIAL EQUIPMENT AND SURPLUS STORES

including Pratt & Whitney DEEP HOLE DRILLING MACHINE; INTERNAL, SURFACE, CYLINDRICAL and ROTARY GRINDERS; S.S. & S.C., CAPSTAN and other LATHES; MILLING MACHINES; HORIZONTAL BORING MACHINE; PLANING MACHINES; RADIAL DRILLING MACHINES; Howard INTERIM SOIL STABILISING TRAIN; Onions SOIL SCRAPER, "Euclid" ARTICULATED SCRAPER, Ahlmann SWING SHOVEL; 3 portable rubber belt ELEVATORS; Barber Greene "Junior" LAYER AND FINISHER; Diesel and Petrol ROAD ROLLERS; 5½ tons ROAD ROLLER SPARES; Double Bucket Swing WEIGHT BATCHER; Pegson POWER RAMMERS; PILE DRIVING EQUIPMENT; Diesel and Petrol MOBILE CRANES; ARC and SPOT WELDERS; Diesel and Petrol GENERATING SETS; Petrol Electric Charging Sets; Coventry Climax Petrol FORK LIFT TRUCKS; 390 Nife Batteries, 40 tons HARDWOOD and SOFTWOOD BATTENS and QUARTERING; 27½ tons GROOVED SOFTWOOD BOARDS; 7½ tons PLYWOOD SHEETS; 678 UNIVERSAL CARRIER KITS; 1,500 TOOL KITS; 4,400 pairs BINOCULARS; 47 HIGH POWER MONOCULAR MICROSCOPES; 1,100 PRISMATIC COMPASSES; 4,950 POCKET WATCHES; 750 STOP WATCHES; 1,100 FREQUENCY METERS with CALIBRATION CHARTS; Scrap Radar and Wireless Equipment; RADIO and ELECTRICAL STORES; Electric Cable, Scrap Batteries; miscellaneous SERVICE CLOTHING; Blankets, Kit Bags, Furniture, Scrap Rubber Outer Covers and Inner Tubes; large quantity of MEDICAL and DENTAL EQUIPMENT, and numerous other effects.

Catalogues, 1s. each, admitting two persons on view days (Tuesday, Wednesday, Thursday, Friday and Monday preceding Sale) and one on Sale Days, may be had, when ready, from the AUCTIONEERS' OFFICES, Dept.X, 10 Lloyd's Avenue, London, E.C.3.

SITUATIONS VACANT

If you do not wish your reply to any Box No. advertisement in this section to be forwarded to certain firms, please advise us. Your reply will then be destroyed, but you will not be notified as this would disclose the identity of the advertiser.

General Manager Wanted for light Engineering works, North London, to control office and production on Automatics and Capstans. Must have held similar position. Apply in strict confidence giving age, qualifications, experience, and salary required.—BOX C864, MACHINERY, Clifton House, Euston Road, N.W.1.

Indian Company Requires Works Manager with initiative and ability, age 30/35, preferably single, to take charge of machine tool rebuilding. First class machine shop experience essential. Excellent prospects, permanent position. Principal visiting London shortly for interviews.—BOX C858, MACHINERY, Clifton House, Euston Road, N.W.1.

Classified Advertisements (*SITUATIONS VACANT, contd.*)

Highly Paid, Secure and Interesting posts are always available for technically trained men. Find out how you can put some letters after your name by preparing at home on "No Pass—No Fee" terms. A.M.I.Mech.E., A.M.I.Prod.E., A.M.S.E., City and Guilds, etc. Full details of exams. and hundreds of courses in all branches of Engineering. Draughtsmanship, Management and Automation Techniques, the benefits of our Employment Dept., and unique record of 95 per cent. successes are given in "Engineering Opportunities"—a valuable 148-page Guide which will reveal many chances you are now missing.—Write for your copy today (stating subject of interest).—FREE and without obligation, B.I.E.T. (Dept. 43a), 29, Wright's Lane, London, W.8.

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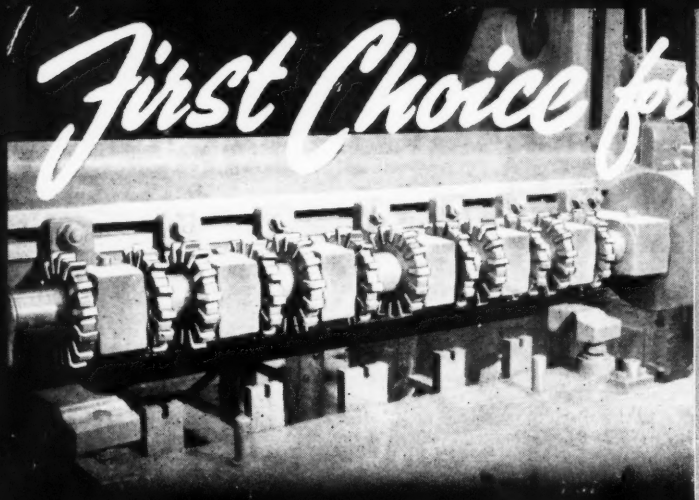

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